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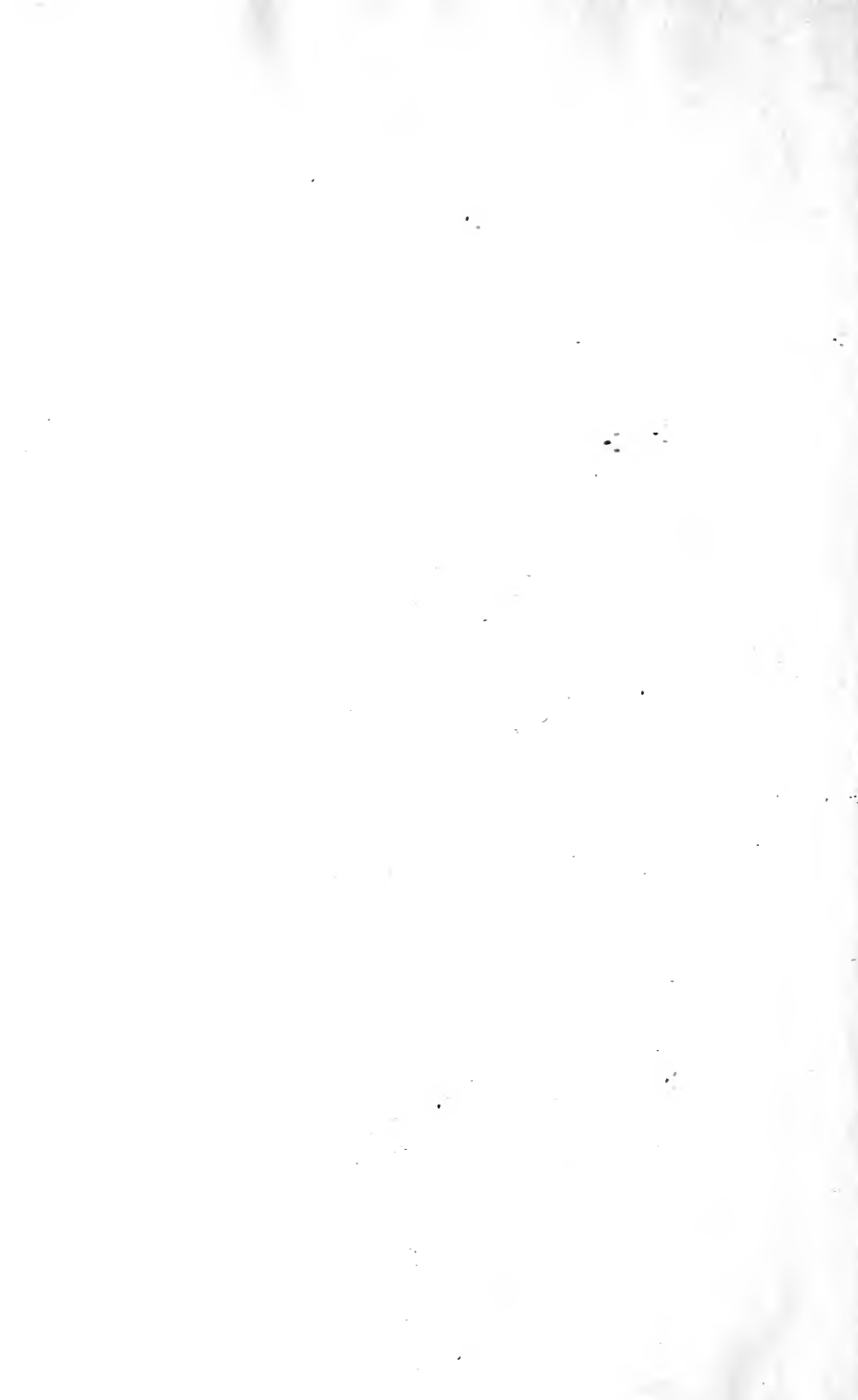
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ARNOLD ARBORETUM
HARVARD UNIVERSITY



ARNOLDIA



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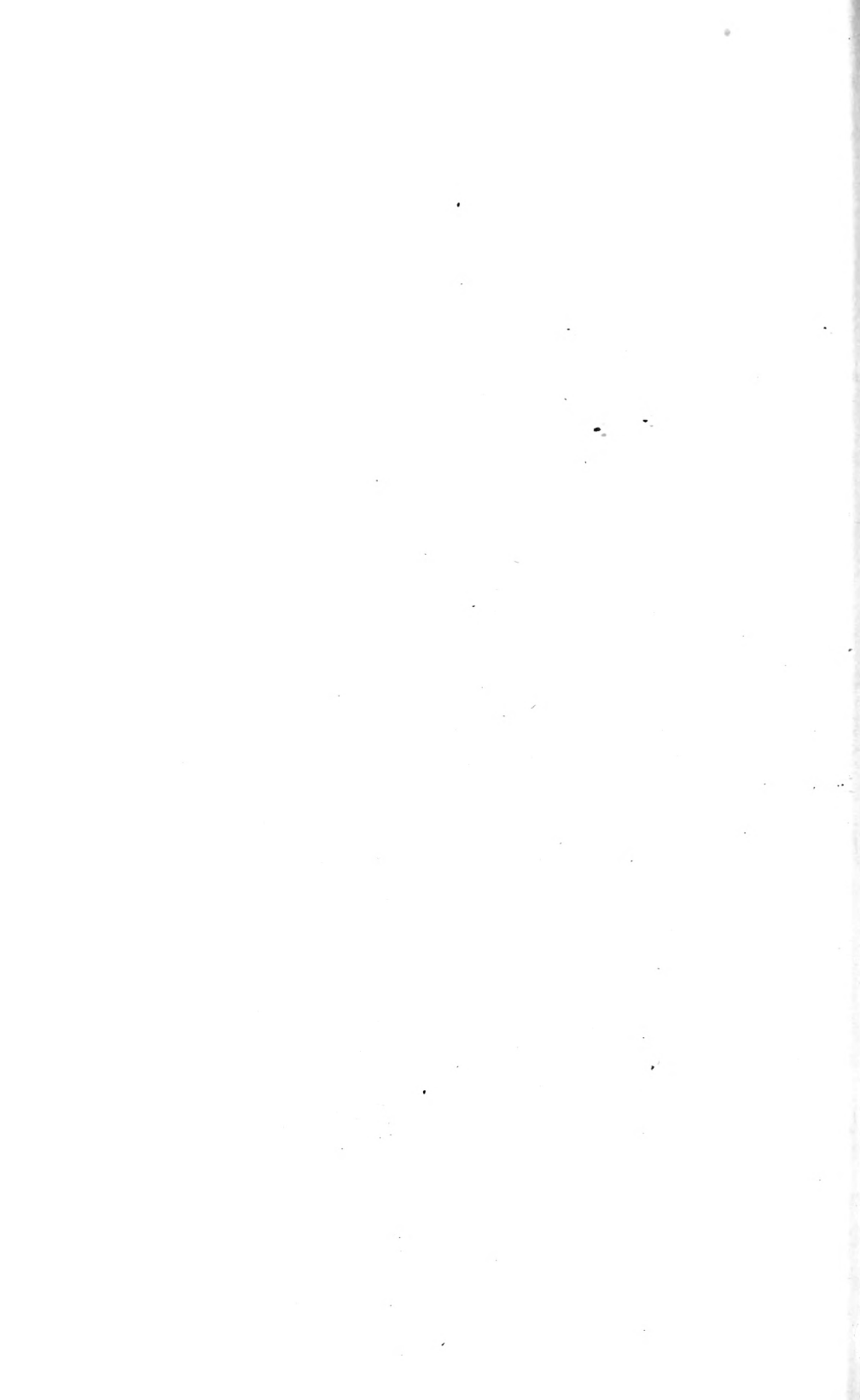
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ARNOLDIA



A continuation of the BULLETIN OF POPULAR INFORMATION of the Arnold Arboretum, Harvard University

VOLUME 3

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NUMBER 1

PLANTING VEGETABLES

THIS spring everyone will be interested in aiding the war effort by growing vegetables. Much is being published in the popular garden magazines about what to plant and when to plant it, as well as by our colleges of agriculture, horticultural societies, and other organizations. The Arnold Arboretum can contribute little to this concerted effort but it is believed that the tabulated data included in this paper will prove to be of value at least to the amateur growers. A careful examination of this table will show that it includes practically all of the necessary information, answering the questions of how much to plant, how far apart to plant, when to plant, and when and how much of a crop to expect.

Varietal names of vegetables purposely are not given, for at the time this table was prepared there was such a demand for vegetable seeds that many of the seed houses were completely sold out of the better varieties. Demands for seeds are three months ahead of schedule. The longer the choice of varieties is delayed, the fewer there will be from which to choose. Many agricultural experiment station and extension service publications are available in the different states wherein the better varieties are listed, and these might be consulted if time permits.

An interesting innovation suggested here is a planting schedule worked out on the basis of the time that certain flowering trees and shrubs are in full flower. In every planting table seen to date, the exact dates of planting are given with the note that allowances must be made for variations in the current season. This always is indefinite. Why not watch some plant growing **in the open in a situation comparable to that of the vegetable garden?** When this plant is in full bloom, or the leaves are appearing—then would be the time to sow certain seeds. The idea, of course, is that the climate governs the blooming periods, hence the suggestion of correlating the time of planting certain vegetable seeds with the time of flowering of certain characteristic native and introduced plants. The old Indian custom was to wait for sowing corn until the leaves on the oaks were the size of a squirrel's ear.

In any event, the sowing of seeds in accordance with nature's time table sounds feasible, and the plant groupings below are offered as illustrating planting dates in the vicinity of Boston. There is no reason why the correlation cannot be made for other regions, even outside of New England.

APPROXIMATE PLANTING DATES

The plants in each group start to bloom about the same time. It is suggested that such plants, if grown in unprotected places, be watched as indicators for planting the different kinds of vegetable seeds. (See Chart pp. 4-5).

I (April 10-20)

Forsythia intermedia
Forsythia suspensa
Epigaea repens
Chionodoxa Lucilliae
Lindera benzoin
Scillas
Salix babylonica - leaves appearing and then turning green

Cornus florida
Darwin Tulips
Malus arnoldiana
Malus floribunda
Malus pumila
Malus purpurea
Paeonia suffruticosa
Prunus persica
Syringa vulgaris
Trollius europaeus

II (April 25-May 5)

Alyssum saxatile
Amelanchier canadensis
Amelanchier laevis
Acer platanoides
Chaenomeles lagenaria
Daphne cneorum
Dicentra spectabilis
Iberis sempervirens
Magnolia stellata
Magnolia Soulangeana
Muscari botryoides
Narcissus Poeticus
Narcissus Barri
Phlox subulata
Primula polyantha
Prunus Sargentii
Prunus subhirtella
Vaccinium angustifolium laevifolium
Vaccinium corymbosum

III (May 15)

Bearded Iris
Berberis Thunbergii
Berberis vulgaris
Cercis canadensis

IV (May 25)

Linum perenne
Lonicera Morrowii
Lonicera tatarica
Malus ioensis plena
Rhododendron nudiflorum
Rosa Hugonis
Spiraea Van Houttei
Viburnum tomentosum plicatum
Wisteria sinensis

V (June 3-5)

Crataegus phaenopyrum
Iris sibirica
Kolkwitzia amabilis
Laburnum vulgare
Paeonia officinalis
Rhododendron calendulaceum
Robinia pseudoacacia
Rosa Harisonii
Rosa multiflora
Rosa rugosa
Sorbus aucuparia
Viburnum opulus

PESTS IN THE VEGETABLE GARDEN

There are many insects and diseases that infest growing vegetables, but only a few are prevalent to any great extent in New England. The following pests are common, and possibly will be encountered in most vegetable gardens this summer. Recommendations for the control of these pests are given by all the state agricultural experiment stations, and are merely repeated here for the sake of convenience and as a part of the Arnold Arboretum's contribution to the Victory Garden program. The most effective control is one which is applied early, before the pests become firmly established. Watch for the pests and apply the dust or spray promptly as soon as they appear.

Cutworms: These are sometimes present in very large quantities and are most troublesome between the middle of May and the middle of June. They feed at night upon newly planted cabbage, eggplant and tomato plants, in addition to many others, cutting the plants off just above the soil level. During the day they hide under stones or in the upper half inch of soil and many can be easily dug up by merely scratching the soil surface. The type which has been particularly injurious around Boston during the past few years is the dingy cutworm.

One method of preventing injury to young plants is to provide them with a collar of stiff paper, placed completely around the stem for one inch below and one inch (or more) above the soil level. Six thicknesses of newspaper would suffice. This collar prevents the cutworms from getting at the succulent young stems.

Sometimes a garden may be severely infested, for the number of cutworms are governed from year to year chiefly by the amount of rainfall the previous year. Much rain forces them to the surface where birds and predatory insects eat them or else the excess moisture prevents the females from laying eggs in satisfactory places. A satisfactory bait which aids in the control of these pests is as follows:

1½ lbs. bran
1 oz. paris green
1 cupful of molasses
juice of one orange or lemon
1½ - 2 quarts of water, mix thoroughly

This should be applied, at the rate of 2½ lbs. per quarter acre, along the rows of vegetables during late May and June when injury is worst. Since the cutworms feed chiefly at night, the fresh bait is best distributed just before sunset. It should be noted that this poisonous bait may be fatal to dogs, cats, and other pets. It should be used with discretion.

Cabbage maggots: These often infest the roots of early planted cabbage and cauliflower plants in June, causing the young plants to wilt and die quickly. Injury to the plants can be prevented if a square or circular piece of heavy paper about 3-4 inches in diameter is placed on top of the soil at the base of the plant. To fit snugly, the paper is slit and a small hole cut at the center, barely large

PLANTING INFORMATION

	How much to produce to plan for		How much seed			How to plant				When to plant	When to mature
	Length row for 1 person for 1 year	Yield expected from this length of row in pounds	Amt. seed per 100' of row	1 pkt. plants in feet of row	1 ounce plants in feet	Inches between rows	Inches between plants	Depth of seed in inches	Germination period in days	Time to plant	Weeks to maturity
Beans bush (snap)	75	30	12 oz	25	10	30	2-4	1	4-8	IV	6-9
Beans bush (lima)	25	5	12 oz	20	10	30	2-4	1	4-8	IV	10-13
Beets	30	20	2 oz	25	50	12	2-4	$\frac{1}{2}$	7-10	I	6-11
Broccoli	20	20	1 pkt	250 plts	—	36	18	$\frac{1}{2}$	4	II	13-17
Cabbage	20	40	1 pkt	250 plts	—	30	20	$\frac{1}{2}$	4	I	11-17
Carrots	70	60	$\frac{1}{2}$ oz	30	200	12	2-4	$\frac{1}{2}$	5-10	I	8-13
Cauliflower	5	5	1 pkt	150 plts	—	30	20	$\frac{1}{2}$	4	II	13-17
Celery	15	30 plts.	1 pkt	400 plts	—	30	6-8	$\frac{1}{4}$	12-15	II	13-17
Chard	5	5	1 oz	25	100	12	20	$\frac{1}{2}$	6-8	I	7-8

Corn	140	110 ears	$\frac{1}{4}$ lb	40 hills	—	30	12	1	4-6	II	8-11
Cucumbers	$\frac{4}{1}$ hills	15	1 pkt	15 hills	—	48	48	$\frac{1}{2}$	6	III	8-13
Eggplant	5	3	1 pkt	100 plts	—	20	24	$\frac{1}{2}$	10	V	13-17
Lettuce	45	10 25 heads	$\frac{1}{2}$ oz	30	200	15	12	$\frac{1}{4}$	4-8	I	7-13
Muskmelons	20	30	1 pkt	15 hills	—	4'	4'-5'	$\frac{1}{2}$	6	III	13-17
Onions seed sets	40	40	$\frac{1}{2}$ oz 1 qt	25 1 lb-50	200	13	2-3	$\frac{1}{2}$ $\frac{1}{2}$	6	I	4-17
Parsley	2	$\frac{1}{2}$	$\frac{1}{2}$ oz	30	200	12	10	$\frac{1}{4}$	18	I	9-14
Parsnips	15	15	$\frac{1}{2}$ oz	20	200	24	2-4	$\frac{1}{2}$	21	I	18-23
Peas	120	60	16 oz	20	7	30	1-2	$\frac{1}{2}$	5-10	I	7-11
Peppers	10	7	1 pkt	100 plts	—	30	15	$\frac{1}{2}$	6	V	13-17
Potatoes	250	250	$\frac{1}{2}$ pk	—	—	30	12	2	—	II	10-17
Radishes	15	15 bunches	$1\frac{1}{2}$ oz	20	75	12	1	$\frac{1}{4}$	3-6	I	3-6
Soybeans	40	8	12 oz	25	10	30	2-4	1	8	IV	14
Spinach	40	20	1 oz	25	100	12	1-2	$\frac{1}{4}$	5-8	I	6-8
Squash	$\frac{4}{1}$ hills	35	$\frac{1}{2}$ oz	10 hills	—	4'-10'	5'-6'	$\frac{1}{2}$	6	III	8-22
Tomatoes	13 plts.	165	1 pkt	200 plts	—	36	24	$\frac{1}{4}$	6	V	7-21
Turnips	20	20	2 pkts	50	250	30	2-4	$\frac{1}{4}$	4-8	I	6-10

enough for the stem of the young plant. The outside edges of the paper are held down with soil. This prevents the fly from laying the eggs in soil cracks at the base of the plants.

Cabbage worms: These are the small worms which infest the heads of cabbage, broccoli, cauliflower and other related plants. They appear from June to September. Lead arsenate spray or dust can be applied until the heads are one-third grown, then pyrethrum dust can be used. If pyrethrum dust is available in sufficient quantity, it might be substituted for the lead arsenate, since lead arsenate is poisonous to human beings and should not be used if at all possible. Rotenone dust is very effective also, but as this may be difficult to obtain later in the season it should be conserved as much as possible. It may be necessary to make two or three applications, preferably while the worms are still small.

Mexican bean beetles: These are the coppery colored "lady bugs" appearing on snap beans and lima beans from July to September. In many gardens they are very numerous and steps must be taken for their control as soon as they appear. The eggs are yellow and are laid on the under surface of the leaves; the spiny, yellowish larvae do most of the damage for they eat holes in the leaves causing the leaves to resemble lacework.

Rotenone or pyrethrum dust are both effective in controlling these insects. (Lead arsenate would be effective except that it should not be used because of its poisonous effect on human beings.) The dust should be applied to the **under surface** of the leaves where the larvae feed. The larvae and insects must be thoroughly covered with the insecticide, and thus it may take two treatments at an interval of three days to control the infestation. There are small dusters on the market which are admirably suited for directing the dust to the under surface of the leaves. Because the mature insects live over winter in old rubbish, it is advisable to pull up and burn all bean plants as soon as the crop has been harvested.

Since rotenone is so effective in the control of the Mexican bean beetle, it is fortunate that the War Production Board still allows its use for this purpose. Rotenone is deadly to insects but not injurious to human beings. Its supply is becoming increasingly limited and an order of the War Production Board (order no. 133 as amended Jan. 23, 1943) restricts its use to the following:—peas (protection against pea weevil and pea aphid); beans (protection against the Mexican bean beetle); cole crops—other than cabbage—including: broccoli, brussels sprouts, cauliflower, kohlrabi, mustard, kale, turnips and collards (protection against caterpillars and aphids); sweet corn (protection against the European corn borer).

Striped cucumber beetles: These beetles are destructive of melons, squash and cucumber plants. They are the most severe pests of cucurbits east of the Rocky Mountains, for they not only feed on the leaves of the plants, but they carry a serious bacterial wilt from one plant to another. They are familiar to every gardener for their black and yellow striped bodies cannot be mistaken. It is very

important that they be controlled, for if these be eliminated, this will control the spread of bacterial wilt.

The use of rotenone is not permitted on cucurbits, and so the next best control method is to use a dust consisting of ten parts calcium arsenate and ninety parts talc. Treatments should be thorough on all plants, and should be repeated at weekly intervals from the time the beetles first appear, which frequently may be when the young plants have from four to six leaves.

Squash vine borers: These borers eat their way into the base of the stems or runners of squash plants causing them to wilt and die before the fruit reaches maturity. It is possible, in small gardens, to watch for these pests and remove them with a knife. Then by covering up the cut portion with moist earth, the stem may continue growth. Since rotenone is unavailable for use on cucurbits, pyrethrum might be used, dusting four times at seven day intervals, the first treatment being given by the end of June. Other sprays recommended are (1) nicotine sulphate, one part in one hundred parts of water with one-half part fish oil soap for a sticker; (2) three pounds of lead arsenate and one quart of fish oil soap in one hundred gallons of water; (3) Bordeaux mixture to which is added some lead arsenate or calcium arsenate. This should be applied three or four times at weekly intervals. It is very difficult to reach the borers since they feed on the inside of the stems, but sometimes these sprays prove to be effective for killing the young insects before they enter the stems.

Potato bugs and potato blight: These common pests are undoubtedly familiar to everyone. Potato growers usually spray from two to six times with Bordeaux mixture to control the blight and other potato diseases. The first spray is applied when the plants are six to eight inches high and other applications follow at intervals of from ten to fourteen days. Earlier applications would be at 4-4-50 strength (hydrated lime—copper sulphate—water) and later applications at 6-6-50. Dry Bordeaux is purchasable from most seed stores, and so the gardener with a small vegetable garden is not confronted with the difficulties of making his own Bordeaux mixture. In using Bordeaux mixture, lead arsenate might well be added when applications are made during late spring and early summer for the control of the potato bug. Or, lead arsenate can be used alone to control the potato beetle, using one pound of lead arsenate to fifteen gallons of water.

Of course there are many other insect and disease pests, often occurring in some sections but absent in others. The few mentioned here are the most prevalent ones. If these are not kept in check, the returns from some of the crops will be very disappointing indeed. If they are kept in check, many gardeners can reasonably expect full returns on the time and money they have invested in their gardens.

DONALD WYMAN

"SYLVA TELLURIANA" OF RAFINESQUE

Last year we announced the facsimile lithoprint reproduction of the very rare "Autikon Botanikon" of Rafinesque, pp. 1-200, originally published in Philadelphia in 1840 in a limited edition. We now announce a similar facsimile lithoprint edition of the equally rare "Sylva Telluriana" of Rafinesque, pp. 1-184, published originally in Philadelphia in 1838. These two very rare botanical volumes have long been entirely unavailable to botanical and other libraries, only about a dozen copies of each being known to be in existence. These modern facsimile editions are much easier to consult than are the originals, as both of Rafinesque's books were printed on poor paper which is now badly discolored. These volumes may now be had from the Arnold Arboretum, the "Autikon Botanikon" reprint being priced at \$3.00 and the "Sylva Telluriana" at \$2.50. If the demand for these is reasonably good, it is probable that the larger and equally rare "Flora Telluriana" of Rafinesque, four volumes, Philadelphia, 1836-38, will be similarly reproduced. This reproduction service is of great importance to the libraries of technical and educational institutions, as copies of the originals cannot be purchased at any price.

JAMES B. CASE MEMORIAL

The Arnold Arboretum of Harvard University has recently received an outright gift of \$50,000.00 from Miss Louisa W. Case of Weston, Mass., together with her residence, barns, greenhouses, and fifty-nine acres of land in Weston, to be utilized for the general purposes of the Arboretum. The real estate is assessed at \$84,000.00, Miss Case's gift thus being in the neighborhood of \$134,000.00. The gift is a memorial to her father, James B. Case. Several hundred hybrid crabapples and cherries have already been planted by the Arboretum staff on the Case estate.

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VOLUME 3

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NUMBER 2

THE NAMING OF HORTICULTURAL VARIETIES

MANY an intelligent plantsman is up against a blank wall when it comes to providing a name for some new plant he thinks he has found. Shall the name be in Latin or in English? Shall it be a botanical variety, a horticultural variety, or a "form"? If it is a hybrid, just what is the correct procedure in order to give it a proper name that will be accepted by horticulturists and botanists alike? There is an ever-increasing tie between the botanist and the practical plantsman, as far as the scientific names of plants are concerned, for both groups have agreed that it is best to follow the International Rules of Botanical Nomenclature, as approved by the International Botanical Congress, Cambridge, England, 1930.

Even though everyone agrees to the International Rules, the naming of new plants is difficult, and in the following discussion it is hoped that the correct procedure for naming new varieties is clearly set forth.¹

Variety

First, it is necessary to understand the concept of a botanical variety. The correct definition would be — A variety is a subdivision of a species composed of individuals differing from other representatives of the species in certain minor characters which are often of geographical significance, and which are usually perpetuated through succeeding generations by seed.

Form

A form is a subdivision of a *species or variety*, usually differing in only one character and often appearing sporadically throughout the range of the species; it is usually perpetuated vegetatively but may be perpetuated by seed, in which case only a certain percentage, as a rule, will be identical with the original form and the remainder will revert to the species or variety.

In some cases no clear line between a variety and a form can be drawn. Also,

¹ See also Jour. Arnold Arb. 10: 65. 1929.

the two terms have been used and are used interchangeably, so that differentiation between the two is often exceedingly difficult. Both the variety and the form as above described should be given a Latin name, and the original published description should include a short Latin description. The form or the variety may occur again in nature, and if it conforms to the original description, it would be given the same name no matter where or when it occurs.

Clon

On the other hand, there is a large group of plants which fail to come true from seed. Individuals in this group may be outstanding, and are perpetuated solely by asexual propagation of one kind or another. Such plants may be considered *forms* or they may be considered *clons* (formerly spelled clones). A clon is a group of plants composed of individuals reproduced vegetatively from a *single* plant. Hence, though a form may also be propagated vegetatively (a clon must be), the form may appear again anywhere at anytime and should be given the same name as its predecessor, whereas the clon constitutes a group of plants propagated from a *single specimen*, and if all the members of this group should happen to die, no plant in the same genus should ever be given the same name again regardless of where or when it occurs.

If the plant is considered a form, it is given a Latin name, and any time in the future that a plant is found conforming to the original description, it takes the same Latin name. In other words, a form name is one given to a group of individuals which may have originated over widely separated areas. A clon name is one given to a single individual and its vegetatively propagated progeny.

If considered a clon, the plant is given a vernacular name — a noun or an adjective used as a noun, in any language, as “Transcendent,” “Snow White,” “Dolgo,” or “Wabiskaw.” Any plant with such a name must be propagated asexually in a direct line from the one original plant.

Selecting the New Name

It is evident from the above descriptions of terms that giving Latin names (species, varieties, forms) to plants should be done by individuals who are trained taxonomists. In the past many plantsmen have tried to give Latin names to so-called “new” individuals, but because they did not know the entire group thoroughly nor the literature on the subject, such names, in many instances, have been proved worthless and unfortunately continue to clutter up many a nursery catalogue.

Consequently, the amateur should give a horticultural varietal name in English; unless he is certain he has a new species, variety or form, in which case he should get confirmation of his Latin name and Latin description from a trained taxonomist who is in a position to know the literature pertaining to the plant group in question.

If a certain plant is given a varietal name in English, it will always designate that particular clon even though some taxonomist at some future date may, in

working over several similar clons, mention their similarity and give a Latin name (variety or form) to the group. This is possible and permissible, but the clon name still remains in use for that particular plant regardless.

Horticultural varietal names in English (i.e., clon names) would be best for most new varieties of *Malus* appearing that may be worthy of naming. Such names should be simple and to the point whenever possible. "Bob White" is a very good one. "Mr. C. S. Sargent" or Prof. C. S. Sargent" are not. The name might better be "Professor Sargent" or "Charles S. Sargent." The same brevity is needed with the prefix "Mrs." or "Miss." It is far better to give the full name, as "Henrietta White" rather than "Mrs. White" or "Mrs. A. R. White," or "Mrs. Alfred R. White." Taking the last two instances as examples, such names are easily confused in making labels and it is never long before such varieties become changed to "Mr. Alfred R. White" and finally to "Alfred R. White."

Rules for Selecting New Horticultural Variety Names

The International Horticultural Conference in London (1930) adopted several resolutions dealing with the naming of horticultural varieties. These have also appeared as an Appendix in the International Botanical Rules published in 1935. It behooves everyone who is interested in the naming of new horticultural varieties to study these resolutions and follow them in selecting new names for all plants.

1. Names of horticultural varieties must not be translated when transferred from other languages, but must be preserved in the language in which they were originally described. Where desirable a translation may be placed in brackets after the varietal name.

2. So far as possible, names of horticultural varieties should consist of a single word; the use of not more than three words is permitted as a maximum.

3. A varietal name in use for one variety of a kind of plant should not be used for another variety of that kind, even though it may be attached to a different species. Thus the use of the name *Narcissus pseudonarcissus* "Victoria" should preclude the use of "Victoria" as a varietal name for any other species of *Narcissus*, such as *Narcissus poeticus* "Victoria." Similarly there should be but one Iris "Bridesmaid," one Plum "Superb," and so on.

4. Varietal names likely to be confused with one another should be avoided. For instance, the use of the name "Alexander" should preclude the use of "Alexandra," "Alexandria," and "Alexandrina" as varietal names for the same kind of plant.

5. Where personal names are used to designate varieties, the prefix Mr., Mrs., Miss, and their equivalents should be avoided.

6. Excessively long words and words difficult to pronounce should be avoided.

7. The articles "a" and "the" and their equivalents should be avoided in all languages when they do not form an integral part of the substantive. For instance, "Colonel," not "The Colonel"; "Giant," not "The Giant"; "Bride," not "The Bride."

8. All the names of horticultural hybrids are formed as provided in the International Rules of Botanical Nomenclature. If a Latin name has been given to a hybrid form of uncertain origin which cannot be referred to a Latin binomial, it must be treated like a vernacular (fancy) name: e.g., *Rhododendron* "Atrosanguineum," *Rhododendron* "Purpureum grandiflorum."

Publishing the Name

To be valid under the International Rules of Botanical Nomenclature, the Latin or scientific names of species, varieties, and forms must be "validly published" in a work accessible to botanists and the public in general, and a short description in Latin must accompany the original description.

In publishing the names of horticultural varieties (clons), the Latin description is not required, but the description in English (or any other language written in Roman characters) should appear in a recognized horticultural or botanical periodical, monograph or other dated scientific publication. The mention of a clon in a catalogue or in the report of an exhibition *without a description* is not considered valid publication even though a figure is given.

Naming Hybrids

From a botanical point of view, a cross may be designated by a formula consisting of the names of two plants joining to make the cross, i.e. *Malus baccata* × *prunifolia*. Whenever it seems "useful or necessary" a name may be given to this cross, i.e., *Malus robusta*, in this case the name being given because the plant has considerable ornamental value, is grown a great deal, and the single name is more usable than the formula; it will include all the crosses however different between the two species, but the individual crosses, treated as clons, retain their horticultural names under it.

It is correct (and always best for the amateur) to use the *formula* in speaking of a new cross, rather than to run into the difficulties of selecting a new Latin name.

It is of the utmost importance to realize that hybrids are made up of clons which vary considerably in many characters. For instance, ×*Malus robusta* is a hybrid (*M. baccata* × *prunifolia*), the fruit and flower sizes varying considerably. In fact, some plants resulting from this cross are practically worthless ornamentally. So, when one merely buys ×*M. robusta*, one may obtain anything within the limits of this cross, some decidedly inferior and some very good ornamentally. But, ×*M. robusta* "Joan" is a clon with definite characteristics, and one is able to know in advance just what characteristics this particular clon will have. Consequently, horticultural varietal names should be given to the offspring of all crosses.

Examples

1. A dogwood is found which has yellow fruits but in every other respect is identical with *Cornus florida*. Is it a variety, form or clon? Upon careful investigation it is found that yellow fruited dogwoods have appeared at widely separated places in the eastern United States. Hence, it is not a clon for it cannot have

been vegetatively propagated from a single specimen. It is not a variety for it differs from the species in only *one* character. Hence, it is a form, and it is given the name *Cornus florida xanthocarpa*.

2. A new crab apple has been found with unusually large double flowers. Nothing exactly like it has been described before, though some of its foliage characters are similar to those of *M. Halliana*, and others similar to those of *M. baccata*. Investigation shows that a cross between these two species has been named "*M. Hartwigii*", but on looking up the description of this cross, the new plant does not seem exactly to fit. Since it obviously is a hybrid it is also a clon, and the name "*Katherine*" is given it. At present it will be known merely as *Malus* "*Katherine*." If at some future time fruits are available (they were not this year), it may be that this will definitely belong to the hybrid species $\times M. Hartwigii$, and then it will be known as *M. Hartwigii* "*Katherine*" or it still may be called *M. "Katherine."* In any event, it will always keep the name "*Katherine*" regardless of what hybrid species it is associated with, and all its offspring must be asexually propagated in a direct line from the one original plant now growing in Durand-Eastman Park in Rochester, New York. (It is always well to use quotation marks around all clonal names to differentiate them unmistakably from all other names.)

Conclusion

In naming new horticultural varieties it is essential to:—

1. Understand the differences between a species, variety, form, and clon as here defined.
2. Understand the rules for naming horticultural varieties as here set forth.
3. Select the name.
 - a. If a species, variety, or form, obtain confirmation from a trained taxonomist regarding the name itself and the Latin description which must accompany its first publication, and which must conform to the International Rules of Botanical Nomenclature.
 - b. If a clon or horticultural varietal name, be certain that it conforms to the rules set down in this paper.
4. Publish the name and description.
 - a. If a Latin name, publish (with Latin description) in some botanical periodical available to botanists and the general public as well.
 - b. If a horticultural name, publish (without Latin description) in some acceptable horticultural or botanical publication easily available to all.

DONALD WYMAN

Notes

Fruits still remaining on shrubs and trees in the Arnold Arboretum on March 26, 1943. Presumably the fruits of other plants have fallen.

- Aronia arbutifolia* - dark brown, withered
 " " "Brilliantissima" - dark brown, withered
 " " macrophylla - " " "
 " melanocarpa elata - " " "
 " prunifolia - " " "
- Berberis canadensis* - a few bright red, still attractive
 " koreana - dark red and withered
 " ottawensis - few, bright red
 " Thunbergii - bright red, still attractive
 " " argenteo-variegata - bright red, still attractive
 " " atropurpurea - dark red
 " " minor - bright red, still attractive
 " verruculosa - pale blue, withered
- Celastrus orbiculata* - orange red, withered
 " scandens - " " "
- Cotoneaster integerrima* - few fruits, dark brown to black, withered
 " obscura - " " " " " "
 " Zabeli - " " " " " "
- Crataegus Lavalleyi* - dark brown, withered
- Ilex glabra* - dull black, withered
- Ligustrum acuminatum* - dull black
 " acutissimum - " "
 " amurense - " "
 " ibolium - " "
 " Itoha Tschonoskii - dull black
 " obtusifolium - " "
 " " Regelianum - dull black
 " vulgare - dull black and withered
 " " sempervirens - dull black and withered
- Malus Hartwigii* - 25% still on, remaining dark brown, withered
 " micromalus - dark brown, withered
 " Zumi "Bob White" - 50% still on, brown, withered
 " " calocarpa - dark brown, withered
- Phellodendron amurense* - dull black, withered
 " chinense - " " "
 " Lavalleyi - few remain, dull black, withered
- Rhodotypos scandens* - dull reddish-black
- Ribes fasciculatum chinense* - red orange, withered

Rosa alba – few remain, brown and withered
 “ *arvensis* – few remain, dark purplish red
 “ *canina inermis* – reddish brown, still attractive
 “ *centifolia* – few remain, brown and withered
 “ *coriifolia* – “ “ dark red, withered
 “ *corymbifera* – dark red, slightly withered
 “ *Luciae* – few remain, brown to black
 “ *Maximowicziana Jackii* – glossy dark red
 “ *micrantha* – few remain, dark red, withered
 “ *multiflora* – glossy dark red, still attractive
 “ “ *cathayensis* – glossy dark red, still attractive
 “ *setigera* – dark dull red, still attractive
 “ “ *serena* – dark dull red, still attractive
 “ *virginiana* – red to black, 75% are withered
Symphoricarpos sp. – few remain but dark brown and withered
Viburnum dilatatum – very dark red, withered
 “ *lobophyllum* – brown to red, withered
 “ *Sargenti* – a few withered fruits remain, red



ARNOLDIA



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WINTER FOLIAGE COLOR OF NARROW-LEAVED EVERGREENS

LAST year a rather complete report was published on the foliage color of woody plants from April to September (*Arnoldia* 2: 57-68, 1942). Another bulletin on autumn color of deciduous plants (*Bull. Pop. Information, Series 4, 4*: 83-90, 1936) covered that period in the fall when deciduous plants are most colorful. This current issue of *Arnoldia* is devoted to the color of narrow-leaved evergreens during the winter, and completes the study of foliage colors of woody plants throughout the year.

This past winter has been an unusual one because temperatures dropped to -20° F. for very short periods on several occasions. This caused considerable winter injury to deciduous plants, and some to evergreens. There were no periods of continuous high winds so that little "burning" of evergreen foliage resulted from wind injury. Consequently, winter injury this year was due largely to low temperatures. A full report of injury to deciduous plants will be given at a later date when the amount of injury will be more evident than it is at present.

Many evergreens change color in the fall and winter, some take on pleasing colors like *Juniperus horizontalis plumosa*, and others take on brownish tones which frequently make the plants look sickly or even as if they might be dying. Several varieties of *Thuja occidentalis* are in this category. The colors of evergreens noted in the following lists were maintained by the plants through the past winter until May 1, 1943, and might well be compared with colors listed in the first reference above.

NARROW LEAVED EVERGREENS

Report on winter foliage color (Oct. 1942-April 1943)

1. Gray (good foliage color)

Chamaecyparis pisifera squarrosa

" " "squarrosa nana"

Juniperus communis "O'Donnell"

Gray (good foliage color, cont.)

Picea glauca

“ *mariana Doumetii*

“ *purpurea*

2. **Yellow** (many plants with yellow foliage turn a dirty *yellowish* in the winter. Those mentioned below maintained their yellow color throughout last winter.

Juniperus chinensis “*japonica aureo-variegata*”

Thuja orientalis decussata

3. **Yellowish** (very poor color for ornamental plants)

Chamaecyparis obtusa “*gracilis aurea*”

“ *pisifera* “*plumosa flavescens*”

Juniperus chinensis japonica

“ “ “*plumosa aurea*”

“ “ *Smithii*

Taxus cuspidata aurescens

Thuja occidentalis Ellwangeriana

“ “ *lutea*

“ “ “*Waxen*”

“ “ *Woodwardii*

“ *orientalis conspicua*

“ “ *elegantissima*

4. **Blue** (good foliage color)

Abies concolor

Chamaecyparis pisifera squarrosa

Juniperus horizontalis alpina

“ *scopulorum*

“ “ “*Chandler’s Silver*”

“ “ *glauca*

“ “ “*Hill’s Silver*”

“ “ “*Marshall’s Silver*”

“ “ “*Medora*”

“ “ “*Moonlight*”

“ *squamata Meyer*

“ *virginia glauca*

Picea pungens Kosteriana

“ “ *Moerheimi*

5. **Bluish green** (good foliage color)

Abies lasiocarpa

Chamaecyparis pisifera minima

Bluish green (good foliage color, cont.)

- Juniperus chinensis mas
- “ “ Sargenti
- “ communis
- “ “ hibernica
- “ horizontalis
- “ “ Douglasii
- “ procumbens
- “ scopulorum “Cologreen”
- “ squamata
- Picea bicolor
- “ Glehnii
- “ pungens
- Pinus monticola
- “ parviflora
- “ sylvestris

6. **Purple** (good foliage color)

- Juniperus horizontalis plumosa
- “ virginiana reptans

7. **Green** (Plants maintaining their green foliage color throughout last winter. Of course the majority of narrow-leaved evergreens belong in this group but are not mentioned here because of lack of space. Because of the diversity of colors among the Junipers, individuals in this species which maintained a good green color are mentioned here)

- Juniperus chinensis Pfitzeriana
- “ “ pyramidalis
- “ “ Watereri
- “ formosana
- “ glaucescens
- “ Sabina tamariscifolia
- “ scopulorum “Emerald”
- “ virginiana – however, this color may vary with different individuals, some being almost purple, some brownish
- “ “ Kosteri – one of the best for a normal green color throughout the winter

8. **Brownish** (Plants not necessarily injured but the foliage of which normally turns brownish in the winter. A very poor color for ornamental plants)

- Chamaecyparis Lawsoniana
- “ obtusa compacta
- “ pisifera aurea
- “ “ “plumosa argentea”

Brownish (plants not necessarily injured . . . , cont.)

Juniperus communis depressa

“ “ “*depressa aurea*”

“ *rigida*

“ *Sabina*

“ *virginiana* – brownish green – some individuals, however, maintain
a dark green foliage throughout the winter

Sequoiadendron giganteum

Taxus baccata aurea

“ “ *Dovastoni* – 50% foliage killed

“ “ *erecta* – injured by the winter

“ “ *lutea* – 50% foliage killed

“ *chinensis* – 75% of foliage killed

Thuja occidentalis ericoides “*Rheingold*”

“ “ *globosa*

“ *orientalis*

DONALD WYMAN

Note: At the time this is being written (May 8) there is comparatively little in bloom at the Arnold Arboretum. The early magnolias and shadblows are very much in evidence. The cherries, which are usually so noticeable at this time of year, have practically no flowers at all. Apparently the flower buds of many *Prunus* species were killed by the cold of last winter. The crab apples, on the other hand, show promise of profuse bloom this spring, probably by the time this publication is in the mail. This is additional evidence in favor of planting more of the sturdy, dependable crab apples. The common *Forsythia suspensa* and *F. intermedia* varieties did not bloom. A few flowers appeared on *F. ovata* and *F. europaea*, and nearly fifty per cent of the flowers appeared on *F. japonica saxatilis*. *Lonicera standishii*, *Cornus mas* and *C. officinalis*, *Lindera Benzoin*, all bloomed as usual. Flower buds on *Corylopsis* species, *Rhododendron mucronulatum*, *Viburnum fragrans* and *Pieris japonica* were completely killed.

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BROAD LEAVED EVERGREENS IN GOOD CONDITION WITH
GREEN FOLIAGE THROUGHOUT THE WINTER

(Oct. 1942 - April 1943)

Arctostaphylos uva-ursi

Buxus microphylla koreana - The only boxwood which was not injured

Calluna vulgaris varieties - all in good condition but these were covered with evergreen boughs and snow during the coldest weather.

Chamaedaphne calyculata - foliage bronze red

Daphne Cneorum

Euonymus Fortunei colorata - foliage bronze red

“ “ *minima* - foliage dark green to bronze red

“ “ “Silver Queen” - leaves variegated

“ “ *vegeta* - in some locations plants have lost up to 30% of leaves

Ilex crenata

“ “ *convexa*

“ *glabra*

“ *opaca*

“ *pedunculosa*

“ *rugosa*

“ *Sugeroki*

“ *yunnanensis*

Kalmia carolina

“ *latifolia*

Mahonia Wagneri - dark reddish purple

Pachistima Canbyi - very dark purplish to green

Pachysandra terminalis

Pieris floribunda

“ *japonica*

Potentilla tridentata - bronze red and dark green

Rhododendron species and varieties – the majority of the rhododendrons came through the winter with very little *foliage* injury—though the flower buds of many may have been killed
 Thymus sp. – green to reddish purple
 Vinca sp. and vars.

BROAD LEAVED EVERGREENS WHICH HAVE BEEN INJURED DURING THE WINTER OF 1942-43

Berberis candidula – all leaves remain on plant but they are brown and dead
 “ Chenaultii – “ “ “ “ “ “ “ “ “ “
 “ Gagnepainii “ “ “ “ “ “ “ “ “ “ “
 “ triacanthophora “ “ “ “ , but a reddish brown
 “ verruculosa – “ “ “ “ , brown and dead
 Buxus sempervirens – all varieties of B. sempervirens had a considerable proportion of their leaves killed
 Cotoneaster Henryana – all leaves remain on plant but brown and dead
 “ microphylla – leaves dark brown, undoubtedly they will soon be dead
 Erica carnea – apparently 50% of plants have been killed
 Hedera Helix baltica – all leaves killed (plant was on a wall growing to a height of 50'). As a ground cover this might not have been so severely injured
 Ilex crenata Helleri – dark green with slight burning
 Leucothoe Catesbaei – 75% of foliage injured
 Lonicera Henryi (growing on the ground) 50% leaves brown, rest green. On trellis 50% of the leaves had fallen and the remainder were all dead
 Mahonia Aquifolium and vars. – reddish purple to brown, considerable injury
 Mahonia repens – reddish purple to brown, some winter injury
 Prunus Laurocerasus Zabeliana – dark green to brown, some injury
 Sasa senanensis – very few leaves green, all others brown and dead

BROAD LEAVED EVERGREENS (SO CALLED) WHICH HAVE DROPPED MANY OF THEIR LEAVES BY APRIL 1943

These plants then cannot be termed completely evergreen in the vicinity of Boston

Abelia grandiflora – leaves entirely dropped
 Akebia quinata – “ “ “
 Berberis Julianae – 75%
 “ mentorensis – 5%
 “ pruinosa – 50%
 “ Sargentiana – 25%
 Cotoneaster adpressa – leaves entirely dropped
 “ glabrata – 50%

Cotoneaster horizontalis - leaves entirely dropped
 " lactea - " "
 " pannosa - " "
 Cyrilla racemiflora - 50%
 Euonymus kiautschovica - 25%
 Iberis sempervirens - leaves entirely dropped
 Kalmia angustifolia - 50%
 Lonicera affinis pubescens - 10%
 " japonica Halliana - leaves entirely dropped
 Mahoberberis Neuberti - 5%
 Pyracantha coccinea Lalandii - all leaves brown and dead
 Viburnum buddleifolium - 10%
 " rhytidocarpum - 25%
 " rhytidophylloides - 10%
 " rhytidophyllum - 50%

NOTES

Crab apples: The crab apples have been at their best all week and will continue to be in full flower over the coming week end. Although the severe winter has seriously injured many shrubs in the Arboretum collections, none of the crab apples suffered except possibly *M. Zumi calocarpa*. There are two trees of this variety at the base of Peter's Hill and both seem to be in very poor condition; the trouble may prove to be fire blight and not winter injury, however. Normally *M. Halliana Parkmanii* is the least hardy of all the *Malus* species and varieties, but this spring it was fairly well covered with flowers. The injuries observed from the unusually cold winter again prove that the crab apples are perfectly hardy in this northern climate and are to be recommended for planting everywhere in the North.

It may be of interest to mention in connection with the crab apples, that a rather comprehensive survey of these important ornamentals has just been completed and is now in the hands of the printer. All of the varieties known to be grown in North America are mentioned, sources where they may be purchased are given, and as complete descriptions of flowers and fruits are given as is possible under the somewhat limited space of the booklet, which approximates sixty pages. A history of the crab apples in North America is given together with a discussion of present experiments in hybridization, the new varieties being grown and recommended for the colder areas of the mid-western United States and the prairie provinces of Canada. Further information concerning this booklet will be given when it is issued a few weeks hence.

Lilacs: As usual, lilacs were uninjured by the low temperatures of the past winter. These are among the most hardy of shrubs and the majority of them should be at their best by the week end of May 22. Cold weather has retarded

their progress considerably this year. In fact, one Boston paper went so far as to publish pictures in the rotogravure section (May 16) of the Lilac Path showing the plants in full bloom: this was not due to any fault of the newspaper, but was taken from information supplied by the Arboretum from records of previous years. It is an excellent example of the difficulties one encounters in predicting from the records of previous years just what may happen this season; always we must consider the idiosyncrasies of the New England weather.

Shrub collection: Visitors to the shrub collection this year will notice that every other grass path through its long lines of shrubs has been dug up and will be kept under cultivation throughout the summer. This has been done in order to eliminate fifty per cent of the work necessary in keeping proper display labels on the plants and also to reduce the amount of grass cutting necessary. It will be possible now to use a power cultivator among these shrubs and so eliminate much of the hand work which in the past has been so consuming. Like many other institutions during this period, the Arboretum is confronted with a labor shortage, making it impossible to keep the grounds in as good condition as in past years. Young men on the labor force have left us or are about to be called into the Army, and it is proving to be very difficult to replace them.

With the very large amount of winter injury many plants are now conspicuous because of dead branches, this being especially true in the shrub collection. These of course will be pruned later in the spring, but the work entailed will take considerably longer than other years and will mean that much evidence of winter injury will unfortunately be noticeable until summer.

Clematis collection: One of the bright spots late this spring, we hope, will be the new clematis collection, planted along the fence at the far end of the linden collection. Of some eighty plants placed there last fall, only seven failed to show new shoots by May 15. Since these were mostly old plants given us by the clematis specialist, Mr. Louis Vasseur of Milton, they should produce a large number of blooms in the late spring and probably up to the end of June. The successful wintering of these plants proves again that clematis can be grown in New England. They may become diseased and die from various other causes, but if the results of this winter mean anything, the demise of a few plants cannot be laid entirely to low temperatures. None of the plants were mulched but the base of each was surrounded with coal ashes to prevent mice from destroying the stems during the cold months.

Equally successful results were obtained in our nursery, where we wintered about forty-five varieties of clematis given by a large grower last fall. These had merely the same protection as those mentioned above and weathered the winter with no greater percentage of loss. These were, moreover, much younger and smaller plants than those in the Vasseur collection, but apparently young plants are no more susceptible to low temperatures than are mature ones.

DONALD WYMAN

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WINTER INJURY IN THE ARNOLD ARBORETUM, 1942-43

LOW temperatures during the past winter have caused considerable injury to trees and shrubs in the Arnold Arboretum, more injury than at any other time since the severe winter of 1933-34, when temperatures in Boston reached an all-time low. Last winter there were no strong winds, the soil was sufficiently moist at the time of freezing so that damage cannot be blamed on lack of moisture then. A study of the temperature records during the ten year period since 1933 demonstrates that significant winter injury can be expected every year when temperatures of below zero are recorded at the Arboretum greenhouses.

A complete listing was made of the plants suffering injury during the past winter and the lists of deciduous trees and shrubs are reproduced in this bulletin. A list of all plants suffering winter injury during the winter of 1941-42 is included since this was a very mild winter and excellent comparisons can thus be made. Not many evergreens were injured, and complete notes on them are to be found in *Arnoldia* 3: 21-23, 1943. In studying these lists, another group of lists should also be studied, these being made by Arnold Arboretum staff members after the severe winter of 1933-34 and published in the *Bulletin of Popular Information*, Series 4, Volume II, Nos. 7, 8, 9, 11, pp. 29-47; 55-60, 1934. These combined lists thus form a rather complete picture of the kind and amount of injury to be expected in mild and severe winters at the Arnold Arboretum.

Minimum temperatures

Maximum and minimum temperature readings are taken daily at the Arboretum greenhouses. It is interesting to note that a study of these shows that temperatures of below zero have been recorded in only three winters since 1933, and each time plants suffered considerable winter injury. The minimum temperature of the 1933-34 winter was -17° F., during 1934-35 it was -8° F., and the minimum for last winter was -13° F. Winter injury may be due to any one of several factors, or to a combination of them, but from a study of the temperatures

and the reactions of the plants themselves it is safe to predict that serious injury will occur to plants when the temperatures drop below zero. By injury is meant the actual killing of flower buds, twigs, and branches. The typical "burning" of evergreen foliage can occur any winter regardless of the low temperature. If the ground is frozen and the air temperatures during the day are considerably higher than during the preceding night and high winds blow, optimum conditions for burning evergreen foliage occur. The minimum temperatures recorded at the Arboretum greenhouses are given below. These vary only a few degrees from the U.S. Weather Bureau official figures for Boston. It is interesting to note that on only seven days in 1933-34 and six days in 1942-43 did the minimum temperatures fall below zero. Only one other time did the temperature go below zero since 1933, and that was seven days in January and February, 1935.

<i>1933</i>		<i>1942</i>	
December 28	-4	December 17	-4
29	-17	19	-7
30	-14	20	-10
		21	-5
<i>1934</i>		<i>1943</i>	
February 7	-2	February 15	-13
8	0	16	-11
9	-18		
10	-3		
14	-4		

In comparing the amount of injury done in these two winters, it should be kept in mind that there were consistently high winds throughout the winter of 1933-34 which must have added materially to the killing of twigs and branches. There were no high winds last winter, nor was the soil too dry when it froze in the fall. However, there are 260 acres in the Arboretum grounds and temperatures are not uniform over the whole area. For instance, on December 29, 1933, when the thermometer at the greenhouse registered -17° F., one in the shrub collection a few hundred feet away (but considerably lower) registered -26° F. It is a known fact that injury is always more severe in the shrub collection on account of its low situation without sufficient air drainage.

There is a question concerning the time the damage is actually done. It will be noted that in both years the temperatures were below zero in December and February, and hence, theoretically, the damage could have occurred at either time. One instance seems to show that it may be the February cold spell which did the killing in 1942-43. Forsythia branches were taken in the greenhouse and forced after Christmas in December, 1942, and the flowers eventually came out in profusion, while branches cut again in late February failed to bloom. We also know that dormancy of many plants is a great deal more difficult to break by forcing in the greenhouse in December than it is in February. However, this

interesting problem as to the exact time injury takes place should be investigated further.

Explanation of lists

The following lists constitute a complete survey of winter injury in the Arnold Arboretum during the past two winters, one a very mild winter and one a severe winter. Many of the plants killed to the ground are sending out new buds from ground level and will grow again; a few were killed completely, although it is still too early to determine this in all cases. *Albizia julibrissin rosea*, for instance, suffered considerable injury. It was not until after June 6 that any branches showed life at all. On the other hand, *Styrax Obassia* showed a normal growth of young shoots when examined on June 1, but after that date all new shoots suddenly withered and died, thus indicating injury to the cambium layers of the main trunk.

The plants growing in the Arboretum are divided into four groups, depending upon how seriously they were injured, i.e., plants killed to the ground, plants partially injured, flower buds only injured, and plants uninjured. It will be noted that some of the names are followed by percentages in parentheses. This is the amount of injury occurring in the winter of 1941-42, and all plants injured during that season are so designated. It may be assumed that all other plants not so designated were uninjured during that winter. Though some discrepancies in the figures are difficult to explain, in most cases the injury in 1941-42 was considerably less than in 1942-43. There was a much larger number of plants injured last winter than the previous one.

In the second list the percentage figures without the parentheses represent the approximate amount of twigs and branches killed. This naturally varies among the plants and the places where they are growing in the Arboretum, but the figures given are comparable.

In the third list, plants with flower buds killed, the percentages not in parentheses represent the approximate number of flower buds on the entire plant which were killed. It is reasonable to surmise that those plants listed as having more than fifty per cent of their branches killed would also have few, if any, flowers. Plants in this group are naturally those in which the flower buds are formed during the previous summer and are thus present all winter. It will be noted that such plants normally bloom from early spring to mid-June, including some of our most colorful ornamentals, among which are the forsythias, the oriental cherries, the magnolias, the wisterias, the azaleas, and the rhododendrons. Plants blooming later in the summer usually form their flower buds on the current year's growth.

All species at present growing in the Arboretum, not included in these lists, were uninjured by the winter cold. However, the mere listing of these would take too much space and would serve no important need: there is, of course, always the question, especially in the minds of those not familiar with the Arnold Arboretum, as to whether a certain species is actually growing there. To emphasize the fact that certain questionable plants did come through last winter unin-

jured, a fourth list has been included. Not all plants of the thousands of uninjured ones could be included in this publication, but the few in the fourth list may prove to be of interest to those who are interested in hardy trees and shrubs.

1. PLANTS KILLED TO THE GROUND DURING THE WINTER OF 1942-43

(The heights given represent the size of the plants killed. The fact that a six foot plant is killed to the ground represents a considerably greater injury than the killing of a younger plant of the same species which is only one foot high. The figures in parentheses denote the percentage in amount of winter injury during the comparatively mild winter of 1941-42.)

Abelia Engleriana 5'

Goucheri 1'

grandiflora 3'

Acanthopanax leucorrhizus 7'

Acer japonicum aconitifolium 10'

Oliverianum 4'

Actinidia chinensis 2'

melanandra 4' (80)

polygama 4'

Alnus Maximowiczii 3'

Amorpha croceo-lanata

fruticosa tennesseensis

glabra

Baccharis halimifolia 6' (20)

Berberis aggregata Prattii 5' (15)

recurvata 3' (30)

"Autumn Cheer" 3'

Beaniana 5'

buxifolia nana 3'

candidula 1'

Chenaultii 3'

Fendleri

"Fireflame" 4'

Gagnepainii 3'

polyantha 3'

rubrostilla 2'

Sargentiana 5'

Wilsonae Stapfiana 6' (30)

subcaulialata 5'

Berchemia racemosa 8' (80)

Buddleia - all except alternifolia

Callicarpa - all species in collection

6-8' (25)

Campsis grandiflora Thunbergii 2'

(80)

Ceanothus pallidus roseus 2' (40)

Celastrus gemmata 6' (90)

hypoleuca 6' (80)

Celtis Tournefortii 3'

Chaenomeles lagenaria cathayensis

3' (90)

Clematis species and varieties 6-8'

Clerodendron trichotomum 10' (80)

Colutea - all species and varieties 6-8'

(20-80)

Coronilla Emerus 4'

Corylopsis platypetala 10'

spicata 6'

Veitchiana 10'

Cotoneaster affinis bacillaris 8'

amoena 2'

conspicua 4'

microphylla 1½'

rotundifolia 3'

rubens 3'

salicifolia rugosa 4'

Cytisus "Burbank hybrids" 6' (20)

sessilifolius 8'

Decaisnea Fargesii 6' (40)

Deutzia "Avalanche" 4'

candelabrum 5'

candida 4' (40)

Deutzia *carnea* 3' (40)
 densiflora 4' (25)
 stellata 4'
 "Contraste" 6'
 elegantissima 6'
 fasciculata 4' (60)
 glomeruliflora 5'
 hypoleuca 3' (80)
 kalmiaeflora 2'
 longifolia and vars. 4' (50)
 "Magicien" 3'
 magnifica and vars. 3'-9' (60)
 mollis 4'
 "Mirabilis" 5'
 myriantha 8'
 reflexa 3'
 rosea and vars. 4'-6' (80)
 scabra and most vars. 4'-6' (30)
 Sieboldiana and var. 5'
 Vilmorinae 3'
Dipelta *floribunda* 12'
 ventricosa 5'
Fraxinus *Paxiana* 4'
Gaylussacia *brachycera* 1'
Genista *cinerea* 2'
Grewia *biloba* 10' (90)
Helwingia *japonica* 4'
Hovenia *dulcis* 25'
Hydrangea *arborescens* and vars. 3'
 cinerea and var. 3'
 quercifolia 4' (15)
 radiata 2'
Ilex *Aquifolium* 3'
 yunnanensis ("large leaf") 1'
 ("small leaf" - no injury)
Indigofera *amblyantha* 10'
Kerria *japonica* and vars. 4' (25-80)
Lagerstroemia *indica* (Cole's
 "hardy" variety) 3'
Lavandula *officinalis* 1'
Lespedeza *bicolor* 4'
 japonica 6'
 Thunbergii 6'

Ligustrum *acuminatum macrocarpum*
 ovalifolium aureo-marginatum (50)
 sinense 10' (30)
Lindera *obtusiloba* 10'
 praecox 12'
Lonicera *affinis pubescens* 5' (70)
 alseuosmoides 1'
 dioica 3'
 etrusca 3' (70)
 gynochlamydea 5' (40)
 Henryi 2'
 involutrata serotina 4' (20)
 Myrtilus 2' (60)
 obovata 3'
 orientalis longifolia 10' (25)
 Periclymenum belgica 4' (50)
 quinquelocularis 9' (25)
 translucens 8'
 saccata (50)
 Standishii lancifolia 6'
Marsdenia *erecta* 3'
Meliosma *Beaniana* 15'
Neillia *ribesoides* 7'
 sinensis 3' (30)
Parrotiopsis *Jacquemontiana* 8'
Periploca *laevigata* 8'
Philadelphus *argyrocalyx* 3'
 "Dame Blanche" 4' (30)
 Lemoinei "Coupe d'Argent" 3'
 subcanus 6' (50)
Photinia *Beauverdiana notabilis* 4'
Physocarpus *capitatus* 6' (15)
Pleioblastus *distichus* 3'
Polygonum *baldschuanicum* 3'
Prunus *Laurocerasus schipkaensis* 4'
Quercus *kewensis* 4'
Rhamnella *franguloides* 4'
Rhododendron *indicum laciniatum* 1'
 "Katie" 2'
 "Nellie" 2'
Rosa *Brunonii* 2'
 Davidi 2'
 Henryi 2'

Rosa *Luciae* 2'
mollis 2' (60)
 "Morica" 3'
Noisettiana 3' (40)
omeiensis chrysocarpa 2' (30)
pteracantha (70)
sempervirens 1½'
Serafinii 1' (50)
Woodsii and var. 2'
Sasa *senanensis* 6' (50)
Sophora *viciifolia* 8' (20)
Spiraea *albiflora* (40)
Blumei 4' (15)
brachybotrys 3' (25)
Bumalda Froebeli 2' (25)
japonica microphylla 2' (50)
ruberrima 2'
Miyabei glabrata 3' (30)

mollifolia 7'
revirescens 3' (70)
rubra 3'
Sargentiana 5'
Zabeliana 4'
Stephanandra *incisa* 5' (50)
Tanakae 4'
Vaccinium *Vitis-idaea* 1'
Viburnum *buddleifolium* 6'
ovatifolium 10'
rhytidophyllum and var. 4'-9'
Vitex *Negundo incisa* 6'-8'
Vitis *Piasezkii Pagnuccii* 8'
pulchra 8' (90)
Weigela *hortensis* 5'
japonica sinica 7'
Zanthoxylum *simulans* 3' (90)

II. PLANTS PARTIALLY INJURED DURING THE WINTER OF 1942-43

(The figures represent percentage in amount of winter injury; the figures in parentheses denote the amount of winter injury during the comparatively mild winter of 1941-42.)

Acanthopanax *setchuenensis* 95
Simonii 50
ternatus 95
Albizzia *julibrissin rosea* 50-98?
Amorpha *brachycarpa* 90
canescens 50
fruticosa 75
nana 80
Artemisia *sacrorum* 25
Berberis *aemulans* 75
aggregata 80
 "Barbarossa" 10
dictyophylla 50
Julianae 90
morrisoniensis 50
triacanthophora 80
verruculosa 50
vulgaris atropurpurea 25
wokingensis 50

Calluna *vulgaris* vars. 10-50 (10-50)
Calycanthus *fertilis* 25
floridus ovatus 50
Caragana *Boisii* 15
Chamlagu 50
densa 50
frutex 20
pekinensis 25
Ceanothus *americanus* 75 (40)
ovatus 25
pubescens 40
Cephalanthus *occidentalis* 90 (50)
Cercis *chinensis* 50
Chaenomeles *lagenaria* "Cardinalis" 10
 "Marmorata" 40
Wilsonii 50
superba 25 (20)
Chionanthus *virginicus* 30

- Clethra acuminata** 5
 alnifolia 10
Corema Conradii 25 (30)
Cornus australis Koenigii 50
Cotoneaster apiculata 50 (30)
 Dielsiana 50
 Henryana 75
 horizontalis 50
 perpusilla 50
 Wilsonii 75
 rotundifolia 50
 Zabeli 50
Corylopsis pauciflora 50
Cyrilla racemiflora 50
Cytisus praecox 75
 purgans 75
 supinus 75
Davidia involucrata 50 ?
Deutzia candelaburm fastuosa 25
 discolor 50
 major 50
 gracilis 75 (30)
 hypoglauca 75 (30)
 Lemoinei 30
 compacta 30 (30)
 parviflora ovatifolia 25
 scabra "Pride of Rochester" 50
 Schneideriana laxiflora 75
Diervilla rivularis 20 (20)
Erica carnea 90
Euptelea polyandra 25
Evodia Daniellii 30
Exochorda Korolkowi 30
 racemosa 25
Fontanesia Fortunei 50
Forsythia suspensa 10
Gaylussacia baccata 10
 glaucocarpa 20
 dumosa 90
 frondosa 10
Genista radiata 50 (25)
Hamamelis macrophylla 50
Helianthemum nummularium vars. 50
Hypericum densiflorum 50
 frondosum 20 (60)
 Kalmianum 20
 prolificum 20
Iberis saxatilis 30
 sempervirens 50
Idesia polycarpa 50
Ilex crenata 50
 decidua 50 (90)
 rugosa 75
 serrata 75 (40)
Itea virginica 80 (50)
Jamesia americana 10
Laburnocytisus Adami 75
Leucothoe racemosa 10
Ligustrum acuminatum 10
 ibolium 25
 Ibota nana 80
 insulare 25
 obtusifolium 25
 ovalifolium 75
 Quihoui 10
 pendulum 50
 vulgare 30
 " 'Lodense' " 75
 pyramidale 50
 sempervirens 50
Lindera Benzoin 30
Liquidambar Styraciflua rotundiloba
 30 (This is a small plant obtained
 from North Carolina)
Lonicera alpigena 10
 Altmannii pilosiuscula 10
 chrysantha Regeliana 10
 deflexicalyx 50 (30)
 fragrantissima 25
 Heckrottii 30
 heteroloba 10
 Korolkovii 30
 microphylla 25
 Morrowii 10

- Lonicera** Purpusii 10
 syringantha 50
 thibetica 10
 Vilmorinii 50 (70)
 Webbiana 30
 xylostoides 10
Lycium chinensis 10 (20)
 halimifolium 50 (25)
 ruthenicum 50
Lyonia mariana 40 (40)
Myrica Gale 50
Paulownia tomentosa, small trees to
 ground, large trees only 25
Periploca graeca angustifolia 75
Pertya sinensis 75
Philadelphus "Bonje" 75
 Burkwoodii 90
 coronarius pumilus 50
 cymosus "Conquête" 25 (40)
 cymosus "Nuée Blanche" 25
 "Rosace" 25 (30)
 Lemoinei 50 (20)
 "Amalthea" 50
 "Avalanche" 50
 "Belle Etoile" 90 (50)
 erectus 50
 "Innocence" 50 (25)
 "Mont Blanc" 50
 Lewisii 75
 "Magdalenae" 50
 nepalensis 25 (20)
 "Norma" 25
 "Pavillon Blanc" 50
 purpureo-maculatus "Sybille"
 sericanthus 50 (30)
 "Sylvanae" 75
 virginalis "Argentine" 10 (80)
 "Glacier" 80
Physocarpus intermedius parvifolius
 10
 stellatus 50 (20)
Poncirus trifoliata 50
Potentilla fruticosa 30
 micrandra 10
 ochroleuca 25
 parvifolia 25 (40)
 tenuiloba 10
 Veitchii 10
Prunus concinna 25
 Fontanesiana 25
 Persica and vars. 50
 (except var. pendula which was
 uninjured)
 pilosiuscula 60
 pumila susquehanae 25
 serrula 20
 serrulata, no vars. had any flowers
 and all apparently suffered se-
 vere twig injury as evidenced
 by many leaf buds failing to
 open by June 1
 "Kwanzan" 75
 subhirtella 50
 autumnalis, intermittent injury
 all along twigs
 pendula 50
Pterocarya hupehensis 50
Pyracantha coccinea Lalandii, foliage
 only killed
Quercus Schochiana 50
Rhododendron obtusum japonicum
 hybrids 25-100
 Arnoldianum 10
 Kaempferi 10
Rhodotypos scandens 50
Ribes diacanthum 25
 futurum 50 (30)
 petraeum Biebersteinii 50
 robustum 50
Rosa arvensis 50
 caudata 50
 centifolia 50
 foetida bicolor 25
 Helenae 50

- Rosa** Lheritierana 75
 multibracteata 50
 multiflora 10
 rugosa "Max Graf" 50
 "Rustica" 10 (30)
 spinosissima fulgens 50
 pimpinellifolia 10
 "Plato" 50
 "Pythagoras" 25 (40)
 Watsoniana 50 (50)
 Wichuraiana 75
- Rubus** deliciosus 50 (20)
- Securinea** suffruticosa 50
- Sorbaria** arborea vars. 10-95
 sorbifolia vars. 50-75
- Spiraea** alba 50
 arcuata 50
 arguta 25
 betulifolia 50 (30)
 Billiardii 50 (50)
 cantoniensis 75 (60)
 chamaedryfolia 30
 cinerea 30 (30)
 corymbosa 50
 Douglasii 50 (25)
 fontenaysii alba 10
 rosea 25
 Foxii 50
 Fritschiana 30
 gemmata 25
 Henryi 50
 hypericifolia and var. 25 (20)
 inflexa 25 (20)
 japonica 10
 atrosanguinea 50 (40)
 ovalifolia 25 (50)
 laevigata 50
 latifolia 25 (30)
 lucida 10
 Margaritae 50
 media and var. 25
 Menziesii 50
 multiflora 25
 nipponica 50
 nudiflora 10
 oxyodon 20
 pachystachys 50 (30)
 prunifolia 25
 pubescens 10
 pyramidata 30
 Rosthornii 90
 salicifolia 20
 Schinabeckii 50
 semperflorens 75
 superba 50
 trilobata 50
 uratensis 25
 Vanhouttei 20
 Veitchii 20
 virginiana serrulata 10
- Staphylea** colchica and vars. 75
- Stewartia** sinensis 50
- Symphoricarpos** albus laevigatus 10
 (15)
 Chenaultii 75 (40)
 hesperius 50
 orbiculatus and var. 50 (30)
- Syringa** emodi 50
- Taxus** chinensis 30
- Ulmus** carpinifolia Dampieri 10
 suberosa 10
 hollandica 30
 major 30
- Vaccinium** corymbosum 10
 hirsutum 25
- Viburnum** Burkwoodii 2
 erosum 25 (20)
 erubescens 90
 hupehense 80
- Vitex** Agnus-castus alba 50 (90)
 Doaniana 50
- Weigela** "André Thouin" 20 (80)
 "E. André" 10 (60)
 florida 10
 "Congo" 25
 variegata 25 (80)

Weigela "Marc Tellier" 10
 "Pres. Duchartre" 20
 "Seduction" 50
 "Vanhouttei" 50 (70)

"Verschaffelti" 20 (35)
Zanthoxylum schinifolium 50
Zenobia pulverulenta 50 (20)
Zizyphus jujuba 10

III. PLANTS WITH FLOWER BUDS ONLY INJURED DURING THE WINTER OF 1942-1943

Figures denote percentage of injury

Abeliophyllum distichum 0-75
Amelanchier canadensis 15-50
Cornus florida 25 Flower clusters have
 the two bracts (outside of bud) in-
 jured and stunted in many cases.
Corylopsis glabrescens 100
Daphne Mezereum 100
Forsythia europaea 10-90
 japonica saxatilis 50
 ovata 75
 × europaea 50-75
 all others 100
Hamamelis mollis 100
Lonicera fragrantissima 75
 praeflorens 100
Magnolia denudata 10
 Soulangeana "Alexandrina" 30
 "Candolleana" 25
 "Norbertiana" 25
 rubra 75
 stellata 25
Pieris japonica 100
Prunus apetalá 95
 avium 90
 canescens 90
 cerasifera and vars. 95
 concinna 100
 cyclamina 100
 Davidiana and vars. 100
 incisa and vars. 75-90
 insititia 99

Juddii 90
 mandshurica 75
 Maximowiczii 100
 nipponica kurilensis 75-95
 Sargenti 75-90
 Schmittii 90
 serrula 100
 serrulata and most vars. 90-100
 tomentosa and vars. 90
 triloba multiplex 99
 yedoensis 100
Rhododendron arbutifolium 90
 catawbiense, many hybrids 25-75
 "Cunningham's White" 100
 dauricum 100
 sempervirens 100
 Fortunei hybrids 20-100
 gandavense many vars. 75
 indicum crispiflorum crosses 100
 laetevirens 90
 molle, many vars. 75
 mucronulatum 99
 obtusum amoenum 95
 arnoldianum 95
 Kaempferi 95
 Schlippenbachii 100
 viscossepalum 75
 yedoense poukhanense 75
Viburnum fragrans 100
Wisteria sp. 100

IV. PLANTS UNINJURED DURING THE WINTER OF 1942-43

(NOTE: It is usually presupposed that all plants not recorded in "injured" lists were not injured. Such is the case with these lists. However, to be certain that some interesting plants are definitely recorded as uninjured, the following list is offered.)

Alyssum gemonense

Betula papyrifera and vars.

Campsis radicans

Castanea mollissima

Cercis canadensis

Celastrus flagellaris

orbiculata

scandens

Chaenomeles japonica "Corallina"

sanguinea

Chamaedaphne calyculata

Daphne altaica

Cneorum and vars.

"Somerset"

Deutzia coreana

glabrata

grandiflora

parviflora

staminea

Dirca palustris

Enkianthus campanulatus

Gymnocladus dioicus

Hamamelis vernalis

Hibiscus syriacus vars.

Ilex montana

yunnanensis

Kalmia latifolia

Kolkwitzia amabilis

Lespedeza kiusiana

Liquidambar Styraciflua

Macludrania hybrida

Maddenia hypoleuca

Magnolia Kobus

salicifolia

Soulangeana speciosa

verbanica

"Waterlily"

Mahonia Aquifolium

repens

Oxydendrum arboreum

Paeonia suffruticosa

Periploca sepium

Pieris floribunda

Prinsepia sp.

Prunus americana

Besseyi (heavy bloom)

cerasus austera

domestica Julianae

glandulosa

Munsoniana

"Newport"

nigra

Padus vars.

salicina

spinosa

tenella var.

Pyrus communis Pyrastr

pyrifolia

ussuriensis hondoensis (very few flowers)

ovoidea

Rhododendron atlanticum

"Boule de Neige"

calendulaceum

canadense

carolinianum

× mucronulatum

catawbiense

album

Fraseri

"Fürst Camille von Rohan"

"Henrietta Sargent"

Rhododendron "Heureuse Surprise"

"Imperialis"

japonicum

narcissiflora

nudiflorum

"Pallas"

"Pucella"

roseum

Smirnowii

speciosum

Vaseyi

Rhus aromatica

Ribes aureum and vars.

odoratum and vars.

Rosa Ecae

Hugonis

Primula

rugosa and most vars.

spinosissima

Spiraea prunifolia simpliciflora

Thunbergii

Staphylea holocarpa

Stewartia koreana

Symplocos paniculata

Tripterygium Regelii

Viburnum rhytidophylloides

Vinca minor and vars.

Xanthorrhiza simplicissima

Zanthoxylum americanum

ARNOLDIA



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GHEENT HYBRID AZALEAS ARE HARDY IN NEW ENGLAND

THESE are probably the most beautiful of all the great group of azaleas, but curiously enough, comparatively few are to be found in the gardens of New England. Many have felt them to belong in the class of tenderer shrubs, while others have believed them too much of a hazard for the amateur to attempt, especially as the initial price seems high. Then, too, they have been often difficult to obtain.

True it is that the novice, just beginning the cultivation of azaleas, is wisely advised to start with our own native species as being the hardiest and surest of success. *Rhododendron calendulaceum*, for example, probably the finest with its range of color from pale yellow to orange and crimson, and with its long season of bloom is so sturdy, that granted the simplest requirements of practically all azaleas, will survive the rigors of the coldest winter and many abuses beside. Another native, the lovely shell pink *R. Faseyi* from the Carolina mountains, is equally sturdy, while *R. nudiflorum*, *R. roseum*, *R. arborescens* and *R. viscosum*, noted for their exquisite fragrance as well as beauty, deserve to rank with the best and strongest of our native shrubs.

Azaleas from the Orient—such as *R. molle*, *R. obtusum* varieties *japonicum* and *Kaempferi*, *R. Schlippenbachii*, *R. mucronulatum*—with their various colors, are deservedly great favorites in our gardens and have been widely planted with varying degrees of success. Hybrids of *R. molle* and *R. obtusum japonicum* have been particularly popular, though not rewarding as to hardiness. But the Ghent hybrid in abundance is likely to be missing, not only from the garden collection but from many nursery catalogues as well.

The history of the creation of this valuable class of azaleas is a fascinating one, but suffice it to say here that Ghent hybrids (*R. gandavense*) are the results of crossing the only European species, the large yellow Pontic Azalea (*R. luteum* or *Azalea pontica*) from the regions of the Black Sea with the American Flame Azalea

(*R. calendulaceum*) and Pinxterbloom (*R. nudiflorum*); sometimes also with the Swamp Azalea (*R. viscosum*) and the Sweet Azalea (*R. arborescens*). Though the first experiments were made in England early in the nineteenth century, the developments of lasting importance came out of Ghent in Belgium in about 1825; and many are the beautiful offspring of this magnificent accomplishment. The species seems to possess so many virtues!—a bewildering range of color running from creamy white through pale yellow and pink, salmon and rose, to flaming orange and red; fine form, which applies not only to the flowers—large in some varieties, medium or small in others, single, double, “hose-in-hose”—but also to the rich foliage and the shrub itself which may in many varieties grow to six or seven feet in height and nearly as wide. Then, too, they have that important asset, delicious fragrance, and last but not least, proven hardiness. This last statement is made after twenty-four years of experience in growing them, as well as close observance of the plantings in the Arnold Arboretum.

These plants in the Arboretum were very likely the first large shipments imported into this country, coming in 1913 and 1914:—from Veitch in England, the rosy “Beauté Célèste,” “Cardinal” and “Flamboyant”; from Wezelenburg in Holland, “Fürst Camille von Rohan,” “General Trauff,” “Minerva,” beautiful salmon rose, the extraordinarily brilliant “Pallas,” “Pucelle,” the crimson “Josephine Klinger,” and the delicate “Heureuse Surprise”; from Koster, the brilliant red “Comte de Flandre,” the lovely “Aurore de Royghem,” the dark “Julius Caesar” and many others. “Gloria Mundi” always stands out as a marvel of orange magnificence!

Besides these in the Arboretum many plants went to nurseries and thence to private growers. One hears that a large percentage of the latter were lost, due to owners not realizing what these rare specimens required in the way of soil, nutrition and natural surroundings. Fortunate it is that those in the Arboretum flourished, and now produce one of the most magnificent displays of any kind to be seen anywhere in May and June! And fortunately, too, enough of those in private hands survived to demonstrate what a satisfactory shrub this can be, because Plant Quarantine No. 37—effective June 1, 1919—cut short the importation of all nursery stock with soil about the roots of the plants, and so our nurseries were thrown on their own to keep alive and propagate these valuable hybrids.

The experience of this writer has been to find them infinitely more satisfactory in every way than the Oriental species: i.e., *R. molle*, *R. Schlippenbachii*, *R. obtusum japonicum*, and even *R. obtusum Kaempferi*. We had some hundred of these *R. grandaevense* hybrids installed in 1919 with almost no loss in Brookline and also in Maine, sixty miles north-west of Portland, where in winter the temperature drops anywhere from ten to forty degrees below zero. Yet not only have the plants proved hardy, but the flower buds have survived as well.

The situation in which these have grown have not been uniform by any means except for the one required fundamental condition—acid soil with plenty of leaf

mold and humus, and protection from hot winds. For instance, "Narcissiflora," the beautiful pale yellow "hose-in-hose" variety grows six feet tall under tall red pines at the eastern edge of the lake at Bryant Pond, Maine, while underneath and growing lower are the brilliant vermilion "Coccinea Speciosa," the clear yellow "Nancy Waterer" and orange "Unique." Cold icy winds tear down the lake in winter, but still these lovely things persist happily. In another spot more secluded, on a gentle slope going to the lake on the south side, these same varieties mixed with the native *R. arborescens* thrive so happily that they seem as at home as the old white pines and maples under which they grow. Across the lake on the side of a sheer wooded mountain are more varieties growing perhaps not so tall, but sturdily nevertheless. The lovely Japanese Torch Azalea also is here but its growth is not so vigorous.

No weeding was necessary after the first year and no feeding has ever been given them, the annual dropping of the soft pine needles making a natural protective mulch and a continuous source of supply. In Brookline, on the other hand, cottonseed meal has been applied to the soil from time to time, and a fall mulch of oak leaves added.

Perhaps the most amazing of all are the specimens which have grown in Maine in a bog by the pool in the sunken garden. This is a natural pool which rises and falls with the changes of water level of the lake, and in spring the roots of the azaleas are almost surely in water. The plants are exposed to full sun practically all of the day until September—the best possible condition of course for setting buds. Here is really a brilliant spectacle when "Minerva" and "Bouquet de Flore" both salmon rose and the pale "Raphael de Smet" cover their branches with a miracle of bloom and fragrance. The trunks of these shrubs are one to two inches thick and the side branches grow so well that long sprays may be used for cutting each year. This also keeps the plant from getting "leggy." Below are the fragrant Swamp Azaleas, absolutely at home, yet a few yards away not a hybrid tea rose will survive a winter, having to be sunk not two, but four feet in the fall, so deep does the frost penetrate the ground. Also it has been found that none of the true rhododendrons can be grown in this locality, yet the supposedly tender *R. gandavense* hybrids live and like it!

It is no news that azaleas can be moved in full bloom, but we put some of these to a terrific test when we dug many of our tallest treasures in August at Bryant Pond, Maine, balled them and sent them to Brookline, Massachusetts in a closed truck. The day they were dug a sudden change in the weather sent the temperature into the nineties for five cruel days, yet all survived and bloomed profusely in the spring, and for two years gave no evidence of the shock they had received. However, conditions in Brookline were not nearly so ideal, and at the end of that time the two main stalks showed no signs of approaching death. Accordingly these were cut to the ground and have since grown into new vigorous plants which are now thriving. This ability to "keep going" after a severe pruning of the dead

wood is a valuable characteristic in these azaleas as it is fortunately in many other deciduous shrubs. No one should decide too quickly that an azalea is dead merely because the main branches look dead.

If one would multiply these hybrid treasures, the layering process is to be recommended. "Irene Koster" a very beautiful but tender and temperamental hybrid—of which out of a thousand imported to this country only six are now known to be alive—thus far having defied all the improved methods of propagation by cuttings, has finally been successfully multiplied by layering. Two years is necessary before severing the layer from the main plant in order to obtain an adequately strong root system.

This past difficult winter has brought one of the severest possible tests to all flowering shrubs (a rare winter indeed when Forsythia buds are killed!) and it was probably one of the worst about here for azaleas. *Rhododendron mucronulatum* failed to bloom; *R. Schlippenbachii*, another early Korean was poor; *R. molle* varieties had many flower buds killed; and *R. obtusum Kaempferi* had flowers in evidence only below the snow line—all the more apparent after last year's glorious array!

On the other hand, all the azaleas native to northeastern United States bloomed well this spring, (see *Arnoldia* 3: 25-36, 1943) with practically no evidence of winter injury.

Coming in far ahead of the orientals and second only to our natives were the *R. gandavense* hybrids—not a hundred percent bloom to be sure, but with flower buds hardy enough to be considered as among the hardiest of azaleas for our New England climate.

All of which goes to show that the native blood in this fine hybrid species is the answer! More and more are hybridizers coming to eliminate the tender *R. luteum* strain and are substituting these strong native parents. Worth while results may be expected along this line.

Now one hopes that many more nurseries will be encouraged to carry these on and that more individuals will know them better through living close to them. Surely they will add even more glory to our great season of flowering shrubs!

BESSIE COLLIER ELLERY
(MRS. WILLIAM ELLERY)

Mrs. Ellery, past President of the Chestnut Hill Garden Club, has been growing magnificent Ghent Azaleas in Maine and in Brookline for many years. They have survived intense winter cold astonishingly well. What she has to say about them indicates their hardiness, adaptability and desirability for planting throughout New England.—Ed.

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NUMBER 8

CRAB APPLES FOR ORNAMENTAL FRUIT

NOW is the time of year when the fruits of the crab apples color brilliantly, red and yellow. Some varieties are outstanding, retaining their colorful fruits for long periods, others are mediocre in this respect, and still others have fruits that remain green until they fall from the trees. Some of the crab apples we value for their beautiful flowers alone, such as the double flowering varieties of *Malus ioensis*, *M. Halliana Parkmanii*, *M. hupensis*, "Katherine" and "Prince Georges," the last two of which are new double flowering varieties. However, these do not have brilliantly colored fruits. In a few forms, such as "Bob White," the small fruits remain on the trees throughout the winter, and these supply a source of food for certain winter birds.

Then there are some like "Beauty," "Bob White," *Malus brevipes* and *M. toringoides* which are valued for their colorful fruits but which are not especially prominent in flower when compared with the better flowering varieties. The best of these useful trees, however, is that group which includes the species and varieties noted for both colorful flowers **and** fruits, such as *M. arnoldiana*, *M. baccata*, "Flame," *M. floribunda*, "Hopa," "Joan," "Montreal Beauty," the *M. purpurea* varieties *aldenhamensis*, *Eleyi*, and *Lemoinei*, "Redflesh," *M. robusta percisifolia*, "Sissipuk," *M. Zumi calocarpa*.

In many old orchards one used to find certain crab apple trees grown for economic purposes, chiefly for making preserves and jellies. "Hyslop," "Transcendent," and "Whitney" are probably the best of these, but "Florence" and "Early Strawberry" are available from one or two nurseries in this country. Modern methods of manufacture and selling have largely eliminated the old-fashioned practice of growing crab apples in the home orchard, for it has become far easier to go to the corner grocery and buy crab apple jelly which has been manufactured in car load lots, than to grow trees and manufacture one's own supply from fruit collected in the home orchard.

Dates between which crab apple fruits are colorful and effective

These dates were recorded during 1942 at the Arnold Arboretum and have been corroborated by observations made in other parts of the United States.

	Aug	Sept	Oct	Nov	Dec	Jan	Feb
angustifolia			o				
x arnoldiana							
x astracantha							
x atrosanguinea							
baccata							
baccata columnaris							
baccata costata							
baccata gracilis							
baccata Jackii							
baccata mandshurica							
BOB WHITE							
bracteata			o				
brevipes							
CHILKO							
coronaria			o				
x Dawsoniana							
DOLGO							
ELISE RATHKE		o					
EXCELLENZ THIEL							
FLAME							
florentina							
floribunda							
fusca							
GIANT			o				
glabrata			o				
glaucescens			o				
Halliana Parkmanii							
Halliana spontanea							
x Hartwigii							
HOPA							
hupehensis							
ioensis			o				
ioensis plena			o				
IVAN							
JOAN							
KINGSMERE							

o = only green fruits and dropping on this date

	Aug	Sept	Oct	Nov	Dec	Jan	Feb
lancifolia		o					
x magdeburgensis							
MAKAMIK							
MATHEWS		o					
MERCER		o					
x micromalus							
MONTREAL BEAUTY							
OLGA							
platycarpa			o				
prunifolia							
prunifolia fastigiata							
prunifolia Rinki							
pumila			o				
pumila Niedzwetzkyana							
x purpurea							
x purpurea aldenhamensis							
x purpurea Eleyi							
QUEEN CHOICE							
REDFLESH							
x robusta				Some	clons	until	x
x robusta erecta							
x robusta percisifolia							
Sargenti							
Sieboldii							
Sieboldii arborescens							
x Soulardii			o				
spectabilis							
spectabilis Riversii							
x sublobata							
sylvestris			o				
toringoides							
Tschonoskii		o					
x Zumi							
x Zumi calocarpa							

o = only green fruits and dropping on this date

Bold face type — botanical species and varieties

Large capitals — outstanding horticultural varieties

Small capitals — lesser horticultural varieties

Newer varieties of economically valuable crab apples are becoming available through a few nurseries in the United States and Canada. Among these varieties, some of which are ornamental as well as useful are "Bedford," "Columbia," "Dolgo," "Osman," "Rosilda," "Scugog," "Wynema" and "Young America." Some of these are grown for their fruits in place of standard apple varieties in the colder parts of Canada where ordinary apples are not hardy.

The length of time that the species and varieties retain their colorful fruits on the trees is of great interest and the chart, pp. 42-43 shows some of the data collected in the Arnold Arboretum last year. The length of time the fruit remains colorful may vary from year to year, but these data represent the normal fruiting season of 1942 and are reprinted from CRAB APPLES FOR AMERICA, recently published by the American Association of Botanical Gardens and Arboretums.

Notes of Interest

CRAB APPLES FOR AMERICA by Donald Wyman, published by the American Association of Botanical Gardens and Arboretums is an 81-page booklet giving detailed information concerning the 260 varieties of ornamental and economic crab apples now being grown in North America, together with sources where they may be obtained. The booklet is the result of a survey made by a committee of the American Association of Botanical Gardens and Arboretums, thus bringing together the combined experiences of this committee and other available information concerning this valuable group of ornamental trees.

This booklet should be owned by everyone interested in growing crab apples for it contains much practical information and will serve as an excellent reference work on this subject. It may be obtained for one dollar from the Arnold Arboretum, Jamaica Plain, Massachusetts. If orders be sent, checks should be made payable to the American Association of Botanical Gardens and Arboretums.

EDIBLE WILD PLANTS OF EASTERN NORTH AMERICA by Merritt Lyndon Fernald and Alfred Charles Kinsey, pp. 422, 124 fig., 25 plates. Idlewild Press, Cornwall-on-Hudson, New York. The Gray Herbarium of Harvard University announces this important publication. More than one thousand species of edible flowering plants and the more important edible ferns, mushrooms, seaweeds and lichens which grow wild in North America north of Florida and east of the Great Plains are considered in this book. One hundred and twenty-five line drawings and twenty-five half tone plates aid materially in the identification of these edible plants and additional notes are given concerning their identification. Recipes for cooking and preserving the different types of vegetables and fruits are given.

This is the most comprehensive and authoritative treatment of our edible wild plants ever prepared. It may be obtained either from the Idlewild Press, Cornwall-on-Hudson, New York, or from the Gray Herbarium, Harvard University, Garden Street, Cambridge 38, Massachusetts. The price, post paid, is \$3.00.

DONALD WYMAN

ARNOLDIA



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VOLUME 3

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NUMBER 9

WOODY PLANTS WITH YELLOW OR WHITE FRUITS GROWING IN THE ARNOLD ARBORETUM

MOST of the berried plants in any landscape planting are those with red, blue or black fruits. Such is the case with barberries, roses and viburnums, three large groups of plants which are highly valued for their ornamental fruits. Shrubs and small trees with yellow or white fruits are just as ornamental especially when grown where their fruits can be viewed in contrast with plants having red or blue fruits. A few such plants, like the bittersweets and snowberries, are easily available from most nurseries, but some of the most striking, like the yellow fruiting viburnums, are very difficult to locate.

The number of plants in each group is not large. Those with white fruits are so limited that plantsmen must depend almost entirely on a few of the shrubby dogwoods and the snowberries. These are commonly available from most nurseries. Those listed with an asterisk in this bulletin are the most ornamental, and nursery sources are given where some of these may be obtained. All are growing in the Arnold Arboretum. A few words about them might be of interest.

Yellow Fruits

Unfortunately, the yellow fruiting Japanese barberry is not outstanding. The fruits are not borne in large numbers nor is the color a brilliant yellow. If it were possible to have a Japanese barberry with fruits a vivid, brilliant yellow, that plant would be of value. Such a barberry has not been developed as yet.

The bittersweets have fruits the capsules of which are yellow. These split open, exposing the brilliant red aril, the fleshy part of the fruit. It should be remembered that all *Celastrus* species have the sexes on separate plants and both staminate and pistillate forms should be planted to insure fruiting. This is often economically done by planting a staminate plant in the same hole with a pistillate plant, allowing the pistillate plant to grow at will but pruning the staminate plant so that only two or three stems will be allowed to grow. These will supply sufficient flowers to pollinize the flowers of a large pistillate plant.

The sea buckthorn, buffalo berry, yew, and the holly also have separate sexes and similar steps must be taken in order to insure their proper fruiting.

The crab apples are noted for their brilliantly colored fruits, but, strangely enough, there are not many with completely yellow fruits, especially fruits which will remain colorful far into the winter. Most of the yellow crabapples have fruits which decay early. The Arnold crab is one example. The fruits are a fine yellow color, but they commence to decay even before the leaves fall from the tree. Many seedlings of *Malus robusta*, *baccata* and *prunifolia* have yellow fruits, and future selections may result in establishing one that will retain its brilliant yellow fruits far into the winter.

The black currant, of course, serves as alternate host for the white pine blister rust and should not be grown in many sections of New England. The poison sumac is a native which naturally should never be used.

The viburnums are really the best of all, for their brilliantly colored fruits stand out just as well as the red fruiting species. Both *Viburnum Opulus xanthocarpum* and *V. Sargentii flavum* have fruits a brilliant, golden yellow, the same size and shape as those of the species. The fruit clusters are so heavy that they often droop, as do those of the species, adding materially to their effective color. The fruits of *V. dilatatum xanthocarpum* are smaller, a lighter yellow color, and borne in rigid upright clusters. These three viburnums are truly outstanding and are well worth planting. The orange fruiting *V. seligerum aurantiacum* is also a good variety, and is included in this list because it deserves being better known.

White Fruits

The common Tatarian dogwood and the native gray dogwood are perhaps the most commonly used white fruiting shrubs. The snowberries come a close second. Unfortunately, in some sections of the country several different diseases attack the fruits of the snowberries and they may prematurely turn black for this reason. The diseases are first noticed on the young foliage in late spring. Using a dormant spray of lime sulfur and burning all diseased canes is one method of controlling these diseases. Another method is to dust the twigs and berries during the late summer with copper-lime dust at about ten-day intervals until freezing weather arrives. All leaves and fallen fruits of diseased plants should be raked up in the fall and burned since the fungus may live over winter in these parts.

The Japanese spurge produces few fruits but in older plantings the small pyramidal fruit clusters are frequently conspicuous. The sumacs are both poisonous to the touch and should be avoided. The white fruiting blueberries last for such a short time that their fruits are practically useless from an ornamental standpoint.

The fruits of *Prunus tomentosa leucocarpa* are the same size as those of the species. Appearing in early summer, at a time when the leaves are fully developed, the fruits of this variety are sometimes so masked by the leaves that they do not stand out markedly. The unusual translucent fruits of *Lonicera quinquelocularis translucens* are delicately unique among the ordinary berried shrubs, and for this reason they attract interest.

Fruits Yellow

(Figures denote nurseries from which available)

Berberis Thunbergii xanthocarpa	Yellow Japanese Barberry
*Celastrus angulata	Anglestem Bittersweet
*Celastrus flagellaris	Korean Bittersweet
*Celastrus orbiculata (most)	Oriental Bittersweet
*Celastrus orbiculata major (6,7)	
*Celastrus scandens (most)	American Bittersweet
*Cornus florida xanthocarpa (9)	Yellowberry Flowering Dogwood
*Cornus mas flava	Yellow Cornelian Cherry
*Crataegus punctata aurea	Yellow Dotted Hawthorn
Crataegus viridis padukensis (orange fruit)	
Daphne Mezereum alba	Yellow fruited February Daphne
Elaeagnus angustifolia	Russian Olive
*Hippophae rhamnoides (orange yellow) (1,7)	Common Sea Buckthorn
*Ilex verticillata "Orange"	
*Lonicera Morrowii xanthocarpa (7)	Yellow Morrow Honeysuckle
*Lonicera Ruprechtiana xanthocarpa (4)	Yellow Manchurian Honeysuckle
*Lonicera tatarica lutea (7)	Yellow Tatarian Honeysuckle
*Malus arnoldiana (4,6)	Arnold Crab Apple
*Malus baccata columnaris	Columnar Siberian Crab Apple
Malus "Bob White"	
Malus "Frau Luise Dittmann"	
Malus "Lady Northcliffe"	
Malus "Orange"	
Malus Scheideckeri	Scheidecker Crab Apple
*Malus "Snowbank" (5)	
Malus spectabilis (yellowish)	Chinese Flowering Crab Apple
*Malus sublobata (4)	Yellow Autumn Crab Apple

NOTE: Various unnamed seedlings, chiefly of *M. baccata*, *M. prunifolia*, and *M. robusta* also have bright yellow fruits.

Prunus angustifolia (red or yellow)	Chickasaw Plum
Prunus cerasifera divaricata	Wild Myrobalan Plum
Prunus Davidiana (yellowish)	David Peach
*Prunus hortulana (red or yellow) (5,7)	Hortulan Plum
*Prunus hortulana "Golden Beauty"	
Prunus lanata (red or yellowish)	Inch Plum
Prunus mandshurica	Manchurian Apricot
*Prunus maritima flava	Yellow Beach Plum
Prunus salicina (yellow or light red)	Japanese Plum
Prunus umbellata (red, yellow or dark purple)	Flatwoods Plum
Prunus virginiana xanthocarpa	Yellow Choke Cherry
Rhus verniciflua	Japanese Lacquer Tree
Ribes nigrum xanthocarpum	Yellow European Black Currant

* <i>Rosa omeinsis chrysocarpa</i>	Goldfruit Omei Rose
<i>Sambucus nigra fructu-luteo</i>	Yellow European Elderberry
* <i>Shepherdia argentea xanthocarpa</i>	Yellow Buffalo Berry
<i>Sorbopyrus auricularis bulbiformis</i>	
* <i>Sorbus aucuparia xanthocarpa</i>	Yellowberry European Mountain Ash
<i>Taxus baccata lutea</i>	Yellowfruited English Yew
* <i>Viburnum dilatatum xanthocarpum</i> (6,7)	Yellowberry Linden Viburnum
* <i>Viburnum Opulus xanthocarpum</i> (7)	Yellow European Cranberrybush
* <i>Viburnum Sargentii flavum</i>	Yellowfruit Sargent Cranberrybush
* <i>Viburnum setigerum aurantiacum</i> (3,6,7)	Orangeberry Tea Viburnum

Fruits White

* <i>Cornus alba</i> (most)	Tatarian Dogwood
<i>Cornus asperifolia</i>	Roughleaf Dogwood
* <i>Cornus racemosa</i> (most)	Gray Dogwood
* <i>Cornus stolonifera</i> (most)	Red Osier
* <i>Daphne Genkwa</i> (2,3)	Lilac Daphne
* <i>Lonicera quinquelocularis</i> (7)	Mistletoe Honeysuckle
* <i>Lonicera quinquelocularis translucens</i> (7)	Whitefruit Mistletoe Honeysuckle
<i>Pachysandra terminalis</i>	Japanese Pachysandra
* <i>Prunus tomentosa leucocarpa</i>	Palefruit Manchu Cherry
<i>Rhus radicans</i>	Poison Ivy
<i>Rhus vernix</i>	Poison Sumac
<i>Sambucus pubens leucocarpa</i>	Pearl Elderberry
* <i>Symphoricarpos albus</i> (most)	Common Snowberry
* <i>Symphoricarpos albus laevigatus</i> (most)	Garden Common Snowberry
* <i>Symphoricarpos hesperius</i> (8)	Washington Snowberry
* <i>Symphoricarpos occidentalis</i> (7)	Western Snowberry
<i>Symphoricarpos orbiculatus leucocarpus</i>	White Coralberry
<i>Vaccinium atrococcum leucococcum</i>	White Downy Blueberry
<i>Vaccinium canadense leucocarpum</i>	White Canada Blueberry

Sources where the most ornamental may be obtained

1. Arapahoe Acres Nursery, Littleton, Colorado
2. Bobbink & Atkins Nurseries, East Rutherford, N.J.
3. W. B. Clarke & Co., San Jose, California
4. Cole Nursery Co., Painesville, Ohio
5. Kelsey-Highlands Nurseries, East Boxford, Massachusetts
6. Kingsville Nurseries, Inc., Kingsville, Maryland
7. Henry Kohankie & Son, Painesville, Ohio
8. Sheridan Nurseries, Ltd., Clarkson, Ontario, Canada
9. Tingle Nursery Co., Pittsville, Maryland

DONALD WYMAN



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SIMPLE KEY TO THE PINES
(Native or available from nurseries in the United States)

THIS simple key is offered chiefly for the benefit of the amateur gardener who is frequently confronted with complicated keys which he finds to be too difficult for his purposes. The key is based primarily on foliage characters which, in most cases, can be observed without the use of a hand lens. It should be clearly understood that any key based primarily on the length of the leaves (and this key is just that) is open to serious criticism because the length of the leaves of any plant will vary with the individual as well as with soil and climate variations, disease infestations, age and altitude at which the tree is growing. Other plant characters vary likewise. However, in order to assist the gardener who has an interest in pines, this key is offered in spite of such just criticism. It includes only those pines which one is likely to find in the woods or nurseries of this country. A few native species have been omitted because they occur only in limited areas, and many exotic species are omitted because they have not yet been widely distributed in cultivation. It goes without saying that the more species included in a key, the more complicated that key becomes.

There are about 80 species of pines distributed throughout the northern hemisphere, 27 of which are growing in the Arnold Arboretum. This key includes all but 5 of the species native to the United States, as well as 15 exotic ones available from nurseries, all in all 35 species of pines.

All measures of leaf length should be considered as approximate only. On one individual tree needles may vary in length from 2 inches to as high as 8 inches, but in the key the length given would be 4 to 6 inches, meaning that *mature* needles—not the young ones which are elongating, nor the ones on weak or on over-vigorous branches—are mostly within the 4 to 6 inch length. If this is clearly understood by those using this key, the key will undoubtedly prove helpful in the identification of most of our commonly grown pines.

The key is designed to be used chiefly with living material, hence the color of the foliage and the general habit of the tree sometimes plays an important part. Occasionally, as in differentiating between *Pinus Strobus* and *P. monticola*, the two species are so much alike that cone characters are used, but these are resorted to only when absolutely necessary, for many a tree which one would like to identify is not graced with cones at the time one wishes to identify it.

This key can be greatly simplified for there are not many pines which are commonly found in any one area in the United States. As an example, let us consider the five-needled pines. In "The Cultivated Conifers," L.H. Bailey lists 15 five-needled pine species of which 11 are growing in the Arnold Arboretum. Thirteen species and 4 varieties are listed in the following key. If this key were designed merely to identify the five-needled pines native to this country, the list would be reduced to 7 species. If the key were to be used in identifying pines native in the northeastern United States only, this part dealing with five-needled pines would include merely *P. Strobus*.

Hardiness is given according to Zones in the Hardiness Map. Habitats are also given, because sometimes such information may prove helpful in assisting in plant identification.

There is no excuse for avoiding a simple key such as this one, merely because of a lack of thorough botanical training. Such keys, when carefully made, are understandable, and if they are used with a full knowledge of their limitations, they will prove most helpful to the gardening public. Identifications made by the use of any key, and this one in particular, should not be considered final, but should be further checked against a complete description in some standard text, and available illustrations.

SIMPLE KEY TO THE PINES
Native or available in North America

Needles in bundles of 2 to 5, rarely solitary, enclosed at the base by a deciduous or persistent sheath **Pinus**

1. Needles 5 in a sheath

- | | |
|-------------------------------------|--------------------------------------|
| <i>albicaulis</i> —White Bark P. | <i>parviflora</i> —Japanese White P. |
| <i>aristata</i> —Bristle-cone P. | <i>parviflora glauca</i> |
| <i>Agacahuile</i> —Mexican White P. | <i>Peuce</i> —Balkan P. |
| <i>Cembra</i> —Swiss Stone P. | <i>pumila</i> —Japanese Stone P. |
| <i>Cembra sibirica</i> | <i>Strobus</i> —Eastern White P. |
| <i>flexilis</i> —Limber P. | <i>Strobus fastigiata</i> |
| <i>koraiensis</i> —Korean P. | <i>Strobus nana</i> |
| <i>Lambertiana</i> —Sugar P. | <i>Torreyana</i> —Torrey P. |
| <i>monticola</i> —Western White P. | |

2. Needles usually less than 1½ inches long with smooth margin **P. aristata**
(California to Colorado) Zone 5

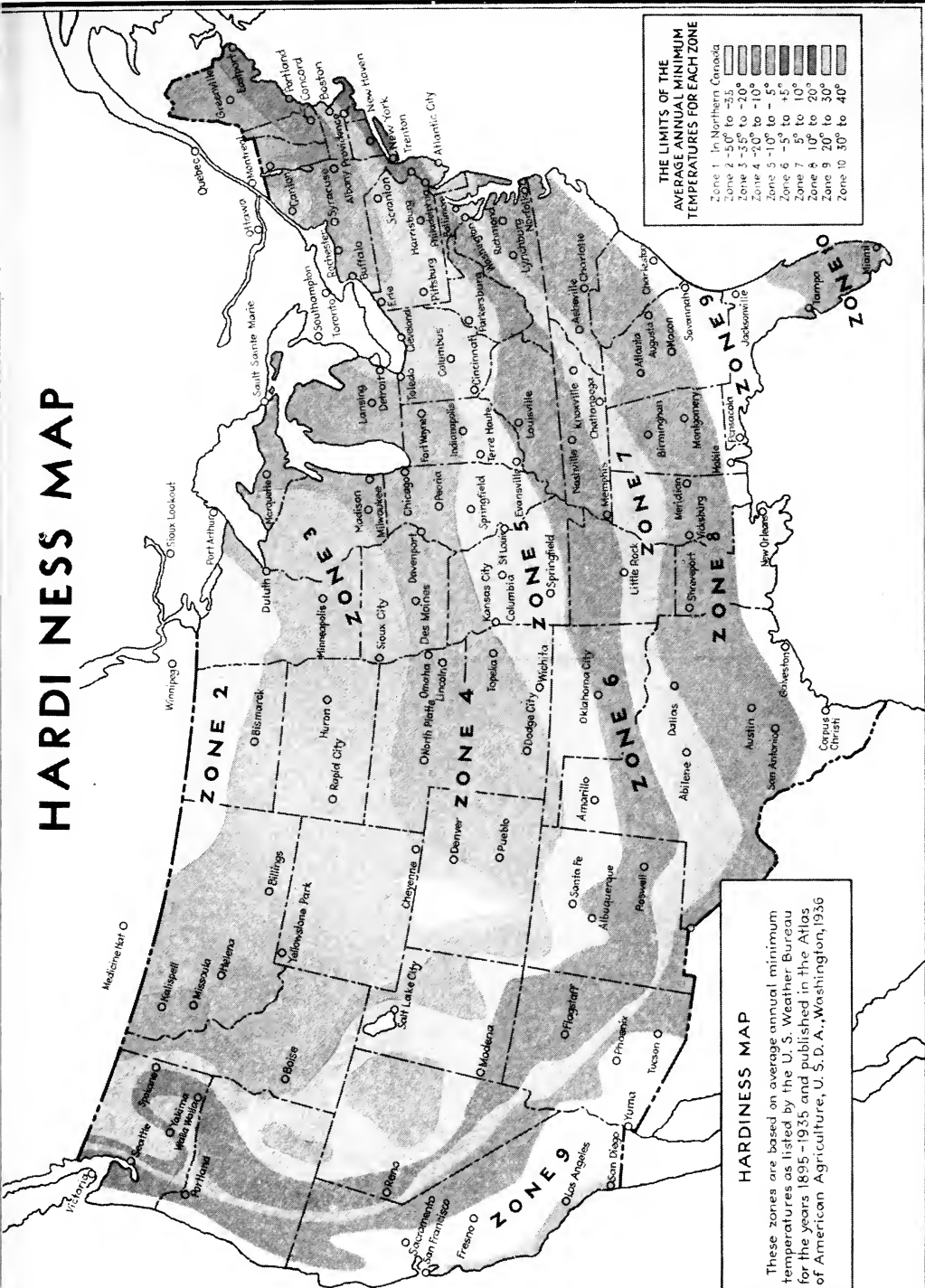
2. Needles usually 1½ to 2 inches long

3. Bark of trunk brown to creamy white, needles rigid and stout, margin smooth **P. albicaulis**
(British Columbia to California) Zone 3
3. Bark of trunk black, needles more flexible
 4. Needles bluish green, often twisted, intensely white underneath, leaf margin finely serrulate, i.e., rough to the touch **P. parviflora**
(Japan) Zone 5
 4. Needles intensely bluish green **P. parviflora glauca**
 4. Needles light green, not twisted
 5. Mature twigs glabrous, needles smooth **P. flexilis**
(Alberta to California) Zone 4
 5. Mature twigs pubescent; leaf margin finely serrulate, i.e., rough to the touch
 6. Tree dense and upright in habit **P. Cembra sibirica**
 6. Tree more open **P. pumila**
(Japan) Zone 5
2. Needles mostly $2\frac{1}{2}$ to $4\frac{1}{2}$ inches long; leaf margin serrulate, i.e., rough to the touch
 3. Mature twigs glabrous
 4. Plant shrubby, not tree-like **P. Strobilus nana**
 4. Branches upright, tree dense
 5. Needles stiff **P. Peuce**
(Balkan Mts.) Zone 4
 5. Needles soft and flexible **P. Strobilus fastigiata**
 4. Branches horizontal, tree more open
 5. Cones usually 2 to $4\frac{3}{4}$ inches long; twigs glabrous or only slightly pubescent **P. Strobilus**
(Eastern U.S. and Canada) Zone 3
 5. Cones usually $4\frac{3}{4}$ to 10 inches long; twigs pubescent when young
(British Columbia to Idaho and California) Zone 5 **P. monticola**
(These two species are difficult to tell apart with the naked eye, except that the habit of *P. monticola* is more narrow and dense and the needles stiffer than are those of *P. Strobilus*.)
 3. Mature twigs pubescent
 4. Tree densely upright, pyramidal in habit **P. Cembra**
(Alps of Europe) Zone 4
 4. Tree not as above, more open
 5. Needles lustrous, dark green **P. koraiensis**
(Japan, Korea) Zone 3
 5. Needles dull green
 6. Terminal bud blunt almost globular, cones 12 to 20 inches
(Oregon to California) Zone 5 **P. Lambertiana**

6. Terminal bud sharply pointed, definitely not globular, cones 4 to 10 inches **P. monticola**
(British Columbia to Idaho and California) Zone 5
2. Needles $4\frac{1}{2}$ to 6 inches. Branchlets finely pubescent, needles bluish green (Mexico) Zone 9 ? **P. Ayacahuite**
2. Needles 8 to 12 inches long **P. Torreyana**
(Southwestern California) Zone 9
1. Needles 3 to 4 in a sheath only occasionally 5; leaf margin smooth **P. cembroides Parryana**
Zone 9 Parry Pinyon P.
1. Needles 3 in a sheath

<i>attenuata</i> —Knob-cone P.	<i>ponderosa</i> —Ponderosa P.
<i>Bungeana</i> —Lace-bark P.	<i>radiata</i> —Monterey P.
<i>canariensis</i> —Canary P.	<i>rigida</i> —Pitch P.
<i>Coulteri</i> —Coulter P.	<i>Sabiniana</i> —Digger P.
<i>palustris</i> —Longleaf P.	<i>Taeda</i> —Loblolly P.
2. Needles mostly 2 to 5 inches long
 3. Leaf sheaths deciduous, bark of older twigs smooth, bark of trunk flaky with white or yellow patches **P. Bungeana**
(China) Zone 4
 3. Leaf sheaths not deciduous, bark of older twigs very rough, bark of trunk dark brown to black
 4. Foliage dark green, cones usually 2 to 4 inches long **P. rigida**
(Eastern U.S. and Canada) Zone 4
 4. Foliage bright or bluish green; cones 3 to 7 inches long
 5. Bark on upper part of trunk and branches smooth **P. attenuata**
(Oregon to California) Zone 8
 5. Bark on upper part of trunk and branches rough **P. radiata**
(S. California) Zone 8
2. Needles mostly 5 to 10 inches long
 3. Winter buds resinous
 4. Twigs fragrant when broken; cones 3 to 6 inches; foliage dark green, branchlets orange brown **P. ponderosa**
(Eastern and Central U.S.) Zone 5
 4. Twigs not fragrant when broken; cones 9 to 14 inches; foliage bluish green **P. Coulteri**
(California) Zone 8
 3. Winter buds not resinous
 4. Foliage bluish green; cones 3 to 6 inches **P. Taeda**
(New Jersey to Florida and Texas) Zone 6
 4. Foliage dark green; cones 5 to 12 inches **P. Coulteri**
(California) Zone 8
2. Needles 8 to 18 inches long

HARDI NESS MAP



3. Foliage gray bluish green
 4. Needles slender, drooping **P. Sabiniana**
(California) Zone 6
 4. Needles stiff, erect **P. Coulteri**
(California) Zone 8
3. Foliage green
 4. Needles mostly 8 to 10 inches long, light green and lustrous
(Canary Islands) Zone 10 ? **P. canariensis**
 4. Needles mostly 12 inches or more long, dark green **P. palustris**
(Southeastern U.S.) Zone 7
1. **Needles 3 and 2 in a sheath**
 - caribaea*—Slash P.
 - cembroides*—Mexican Pinyon P.
 - echinata*—Shortleaf P.
 - ponderosa scopulorum*—Rocky Mountain Ponderosa P.
 - tabulaeformis*—Chinese P.
2. Needles less than 2 inches long **P. cembroides**
(Southern California and Arizona) Zone 9
2. Needles more than 2 inches long
 3. One year twigs greenish to purplish, covered with glaucous bloom
(Eastern U.S.) Zone 5 **P. echinata**
 3. One year twigs yellow brown to brownish
 4. Terminal bud very resinous **P. ponderosa scopulorum**
(Rocky Mountain Region) Zone 4
 4. Terminal bud not resinous or only slightly so
 5. Needles 2 to 7 inches long; cones $1\frac{1}{2}$ to 2 inches long
(China) Zone 5 **P. tubulaeformis**
 5. Needles 8 to 12 inches long; cones 3 to $6\frac{1}{2}$ inches long **P. caribaea**
(Southeastern U.S., Bahamas, Honduras) Zone 8
1. **Needles 2 in a sheath**
 - Banksiana*—Jack P.
 - densiflora*—Japanese Red P.
 - densiflora oculus-draconis*
 - densiflora umbraculifera*
 - echinata*—Shortleaf P.
 - Mugo*—Swiss Mountain P.
 - Mugo compacta*
 - Mugo pumilio*
 - nigra austriaca*—Austrian P.
 - nigra Poirietiana*
 - Pinaster*—Cluster P.
 - pungens*—Table Mountain P.
 - resinosa*—Red P.
 - sylvestris*—Scotch P.
 - sylvestris aurea*
 - sylvestris rigensis*
 - sylvestris Watereri*
 - tabulaeformis*—Chinese P.
 - Thunbergii*—Japanese Black P.
 - virginiana*—Virginia P.
2. Needles $\frac{3}{4}$ to 3 inches long .
3. Foliage with each needle marked with a yellow band
P. densiflora oculus-draconis

3. Foliage bluish green, bark of upper trunk red **P. sylvestris** and vars.
(Europe) Zone 2
4. Young foliage at first yellow, changing later to bluish green
P. sylvestris aurea
4. Bark very red, trunk tall and straight **P. sylvestris rigensis**
4. Habit low, dense, pyramidal, needles steel blue **P. sylvestris Watereri**
3. Foliage green
4. Plant usually shrubby, with several main branches from the base
5. Needles $\frac{3}{4}$ to 2 inches long, bark black **P. Mugo** and vars.
(Central Europe) Zone 2
6. Dense almost globose shape . . . **P. Mugo compacta**
6. Shrubby, upright habit . . . **P. Mugo pumilio**
5. Needles 3 to 5 inches, bark red to reddish **P. densiflora umbraculifera**
4. Plant a tree with a central leader
5. Needles mostly one inch long . . . **P. Banksiana**
(Northeastern U.S. and Eastern Canada) Zone 2
5. Needles $1\frac{1}{4}$ to 3 inches long
6. Branchlets usually with glaucous bloom, often greenish to purplish
or yellowish
7. Foliage bluish green, cones usually not persistent, bark of upper
trunk red; leaves flexible . . . **P. densiflora**
(Japan) Zone 4
7. Foliage bright green, cones persistent, bark of upper trunk black;
leaves stiff . . . **P. virginiana**
(Eastern U.S.) Zone 4
6. Branchlets without glaucous bloom, orange to yellow
7. Vigorous shoots often with more than one whorl of branches on
the current year's growth . . . **P. pungens**
(Southeastern U.S.) Zone 5
7. Vigorous shoots with only one whorl of branches on the current
year's growth
8. Winter buds white or whitish to light yellow **P. Thunbergii**
(Japan) Zone 4
8. Winter buds dark brown . . . **P. tabulaeformis**
(China) Zone 5
2. Needles 3 to 8 inches long
3. Winter buds resinous
4. Needles slender and flexible not breaking when bent **P. resinosa**
(Northeastern U.S. and Eastern Canada) Zone 2
4. Needles stout and stiff breaking when bent **P. nigra austriaca**
(Central Europe) Zone 4
5. Branches more ascending . . . **P. nigra Poiretiana**
3. Winter buds not resinous (or only slightly so in *P. tabulaeformis*)

4. Buds stout, up to one inch long; branchlets bright reddish brown
(Portugal to Greece) Zone 8 **P. Pinaster**
4. Buds less than $\frac{1}{2}$ inch long
5. Bark of upper trunk red **P. densiflora**
(Japan) Zone 4
5. Bark of upper trunk black .
6. One year twigs with glaucous bloom, green to purplish **P. echinata**
(Eastern U.S.) Zone 5
6. One year twigs without glaucous bloom, yellow to brown
7. Winter buds dark reddish brown **P. tabulaeformis**
(China) Zone 5
7. Winter buds light yellow to white or whitish **P. Thunbergii**
(Japan) Zone 4

DONALD WYMAN

Note: The demand for copies of “Crab Apples For America” has been so great that a second printing has been ordered. Copies may be obtained by writing the Arnold Arboretum, Jamaica Plain, Mass. and enclosing a check for \$1.00 made out to the American Association of Botanical Gardens and Arboretums.

ARNOLDIA



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BULLETIN OF POPULAR INFORMATION
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VOLUME 3

DECEMBER 17, 1943

NUMBER 11

SIMPLE FOLIAGE KEY TO THE HEMLOCKS AND SPRUCES

THIS is a group of narrow leaved evergreens which is extremely difficult to identify from foliage characters alone. Especially is this true of the spruces. One of the reasons they are difficult is because of the fact that the needles soon fall off when they are dry. The key which follows is prepared solely for the determination of material which is fresh. It cannot be used with dead material. Such a key has its good points and its bad points—good because the obvious characteristics such as color of foliage and twigs are used and it can be used in the field without the use of a lens (in most cases), bad because the key is only usable for the period of a few days after the branches have been taken from the living tree.

All that is said in *Arnoldia*, Volume 3, No. 10, 1943, describing the Key to the Pines, is also applicable to this key to the spruces and hemlocks. The key is offered for the garden enthusiast who is not a trained botanist, but the key should not be used as a means of final identification, standard texts and illustrations should be consulted.

Most of the characters used can be observed with the naked eye. Since many nurserymen grow the spruce species from seed, there is the opportunity for hybrids to creep into the trade and obviously these always prove troublesome in any key.

It is interesting to note that there are only 7 species of spruce native to North America, and all are included in this key. There are about 22 species available in the trade, all of which are included in the key, as well as 10 varieties in addition. There are about 26 varieties of *Picea Abies* offered by various nurseries, and the differences among these are frequently so slight, especially in the younger stages of plant development, that it is impossible to make a satisfactory key for them. Consequently, it has only been possible to list the dwarf varieties of *P. Abies* as a group.

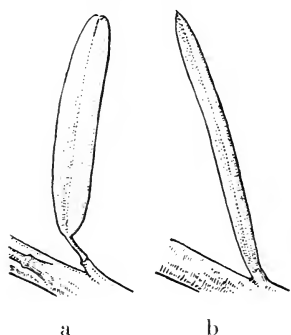
Of the hemlocks, four species are native and these are included in the key of six species. At least 15 varieties of *Tsuga canadensis* are offered in the trade and probably many more. It was impossible to make a foliage key for these because in many cases their differentiation depends on their shape alone.

As in the Key to the Pines, habitats are given for all species and Hardiness Zones refer to the Hardiness Map, *Arnoldia*, Vol. 3, No. 10, 1943, p. 53.

FOLIAGE KEY TO THE HEMLOCKS AND SPRUCES (Native or available in North America)

Needles borne singly, leaf bases persistent **Picea and Tsuga**

1. Needles narrowed at base to form distinct petioles **Tsuga species**



This character must be clearly interpreted. Sometimes when the needle of a spruce is pulled off, a small portion of the twig bark also comes off, looking like a petiole unless observed with a lens. The needles of all spruces are without petioles, their leaf-blades being attached directly to the twig.

FIGURE 1. Needle of hemlock (a) with petiole and spruce (b) without petiole.

canadensis—Canada Hemlock

caroliniana—Carolina H.

diversifolia Japanese H.

heterophylla—Western H.

Mertensiana—Mountain H.

Sieboldii—Siebold H.

2. Needles with white lines on under surface only, cones less than 2 inches long

3. Needles noticeably blunt and notched at tip

4. One year branchlets pubescent **T. diversifolia**
(Japan) Zone 5

4. One year branchlets glabrous **T. Sieboldii**
(Japan) Zone 5

3. Needles not noticeably notched at end but rounded

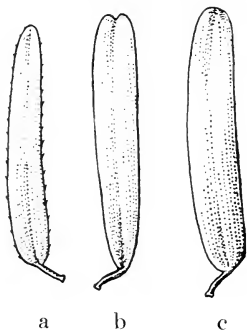


FIGURE 2. a. *Tsuga canadensis*. The very fine serrulate margin can only be seen with a lens.

b. *Tsuga Sieboldii*

c. *Tsuga caroliniana*

4. Many of the needles on vigorous one year shoots wider at base than at the tip; i.e., gradually tapering from base to tip; needles mostly two ranked, in one plane, and with a very fine serrulate margin (when examined with a lens); cones $\frac{3}{4}$ inch or less in length **T. canadensis**
(Nova Scotia and eastern U.S.) Zone 4
4. Majority of needles on vigorous one year shoots not tapering but about as wide at base as at tip; needles in several planes about twig; needle margin of *T. caroliniana* entire and *T. heterophylla* is serrulate (when examined with a lens). Cones longer than $\frac{3}{4}$ inch
5. One year twigs orange brown, cones 1 to $1\frac{1}{2}$ inches long
(Southeastern U.S.) Zone 4 **T. caroliniana**
5. One year twigs pale yellowish brown: cones $\frac{3}{4}$ to 1 inch long
(Alaska to Idaho and California) Zone 6 **T. heterophylla**
2. Needles with white lines on upper and lower surfaces, cones 2 inches or more in length **T. Mertensiana**
(Alaska to Idaho and California) Zone 5

1. Needles without distinct petioles

Picea species

<i>Abies</i> —Norway Spruce	<i>Omorika</i> —Serbian S.
<i>Abies</i> vars.—some 26 varieties available in the trade	<i>orientalis</i> —Oriental S.
<i>asperata</i> —Dragon S.	<i>orientalis aurea</i> —Bronze Oriental S.
<i>bicolor</i> —Alcock S.	<i>polita</i> —Tigertail S.
<i>Breueriana</i> —Brewer S.	<i>pungens</i> —Colorado S.
<i>Engelmanni</i> —Engelmann S.	<i>pungens argentea</i> —Silver S.
<i>glauca</i> —White S.	<i>pungens Bakeri</i> —Baker S.
<i>glauca albertiana</i> —Alberta S.	<i>pungens glauca</i> —Blue Colorado S.
<i>glauca conica</i> —Dwarf Alberta S.	<i>pungens Kosteriana</i> —Koster S.
<i>glauca densata</i> —Black Hills S.	<i>pungens Moerheimii</i> —Moerheim S.
<i>Glehnii</i> —Sakhalin S.	<i>purpurea</i> —Purple Cone S.
<i>jezoensis</i> —Yeddo S.	<i>rubens</i> —Red S.
<i>Koyamai</i> —Koyama S.	<i>Schrenkiana</i> —Schrenk S.
<i>mariana</i> —Black S.	<i>sitchensis</i> —Sitka S.
<i>mariana Doumetii</i> —Doumet S.	<i>Smithiana</i> —Himalayan S.
<i>obovata</i> —Siberian S.	<i>Wilsonii</i> —Wilson S.

2. Needles on current year's growth mostly at right angles to twig; also see Fig. 5, p. 61. (NOTE: In no specimen are *all* the needles exactly at right angles to the twig. Some needles always point towards the end of the twig hence making an angle less than a right angle. However, the plants in the group with needles at right angles should have more than fifty per cent of their needles at right angles to the twig. In case of reasonable doubt, certain plants can be located again under the second No. 2—"Needles mostly at an angle considerably less than a right angle.")

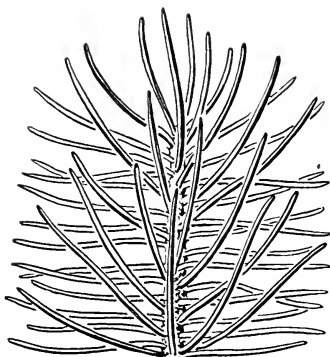


FIGURE 3. Tip of one year shoot of *Picea pungens* showing a majority of the needles nearly at right angles to the twig.

3. Needles $\frac{1}{2}$ inch long or less
 4. Needles showing intense white lines when observed from tip looking towards base of branch; branchlets pubescent
 5. Plant a tree, loose and open in habit **P. mariana**
(Labrador to Alaska; Wisconsin and Michigan) Zone 2
 5. Plant not so tall, dense conical habit **P. mariana Doumetii**
 4. Needles not showing intense white lines, plant a low dense pyramid of tightly compact light green foliage; branchlets glabrous **P. glauca conica**
3. Needles mostly more than $\frac{1}{2}$ inch long
 4. Terminal bud lustrous, dark brown, prominent, about $\frac{1}{4}$ inch long; its tight fitting scales remaining snugly tight fitting and blackish at base of branchlets for several years **P. polita**
(Japan) Zone 5

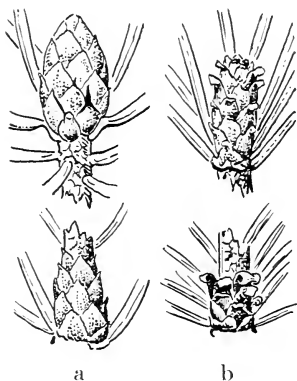


FIGURE 4. End bud and base of one year shoot of *Picea polita* (a) and *Picea Abies* (b) showing the tight fitting scales on bud and shoot base of *P. polita* as compared with those of *P. Abies*.

4. Terminal bud not lustrous nor as prominent, light brown. The scales, if they remain at the base of the current year's branchlets are curled and indistinct, not snugly tight fitting
5. Foliage of one year twigs definitely blue **P. pungens glauca**
P. pungens argentea
P. pungens Moerheimii

The only way to tell these three apart is to determine the *degree* of blue color. *P. pungens glauca* is the least blue, *P. pungens argentea* the typical "Koster's Spruce" of the trade is next, and *P. pungens Moerheimii* is the deepest blue.

NOTE: (Visualize the blue of *P. pungens argentea* [the typical "Koster's Spruce" of the trade, sometimes incorrectly named *Kosteri* or *Kosteriana*] and the green of the Norway spruce. These are the two sharp color divisions. Plants with foliage a color between these two extremes come under the second No. 5—"Foliage bluish to grayish green"

5. Foliage bluish to grayish green
 6. Needles rigid, extremely sharp to the touch, one year shoots strong and vigorous often 6 to 10 inches long
 7. Needles frequently curved **P. asperata**
(West China) Zone 5
 7. Majority of needles straight **P. pungens**
(Wyoming to New Mexico) Zone 2
 6. Needles not so rigid and sharp to the touch, one year shoots not so vigorous
 7. One year twigs greenish gray **P. Wilsonii**
(Central and West China) Zone 5
 7. One year twigs yellowish to orange brown **P. glauca**
(Canada and northern U.S.) Zone 2
5. Foliage uniformly green. Usually most of the needles of this species are not at right angles to the twigs but sometimes on very vigorous shoots they are **P. Abies**
(North and Central Europe, naturalized in eastern U.S.) Zone 2
2. Needles on current year's growth mostly at an angle considerably less than a right angle with the twig; i.e., needles pointing towards the tip of the twig. Also see Fig. 3, p. 60.

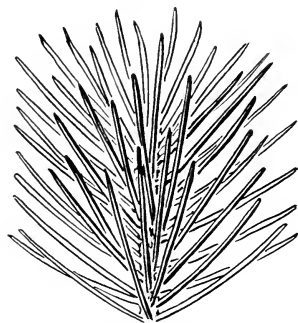


FIGURE 5. Tip of one year shoot of *Picea Engelmannii* showing a majority of the needles at less than right angles to the twig.

3. Foliage of current year's shoots uniformly blue. (NOTE: Visualize the blue of *P. pungens argentea* [the typical "Koster's Spruce" of the trade]

and the green of the Norway spruce. These are the two sharp color divisions. Plants with foliage a color between these two extremes come under the second No. 3—"Foliage bluish to grayish.")

4. One year twigs densely pubescent, noticeable without a lens
(British Columbia to Arizona) Zone 2 **P. Engelmanni**

4. One year twigs glabrous . . . **P. pungens Bakeri**

5. Plant with rigid, horizontal branches . . . **P. pungens Kosteriana**
(Not to be confused with the Silver spruce, *P. pungens argentea*, which does not have pendulous branchlets)

3. Foliage of current year's growth bluish to grayish or whitish; especially when viewed from tip of branch, looking toward base of branch: green when viewed from above the branch

4. Needles $\frac{3}{4}$ inch or less in length
5. One year twigs greenish gray . . . **P. purpurea**
(West China) Zone 5

5. One year twigs yellowish to brown
6. Needles flat in cross section

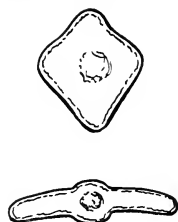


FIGURE 6. Cross section of needle of *Picea Omorika* (below) and *Picea glauca* (above).

7. Winter buds resinous
8. Branchlets glabrous and horizontal, foliage intensely white when viewed from underneath the branch
9. Needles pungent, $\frac{1}{2}$ to 1 inch long **P. sitchensis**
(Alaska to California) Zone 6
9. Needles not pungent, $\frac{1}{2}$ to $\frac{3}{4}$ inch long **P. jezoensis**
(Manchuria and Japan) Zone 4

8. Branchlets pubescent, usually markedly pendulous: foliage not intensely white when viewed from beneath
(Oregon to northern California) Zone 5 **P. Breweriana**

7. Winter buds not resinous; branchlets pubescent **P. Omorika**
(Southeastern Europe) Zone 4

6. Needles angular in cross section, usually 4-sided
7. Two and three year old twigs black on upper side of branch at least, giving a dark appearance to the tree; needles sharp; branchlets pubescent **P. mariana**
(Labrador to Alaska, Wisconsin to Michigan) Zone 2

7. Two year twigs usually light brown: branchlets glabrous, needles blunt
8. Tree slow growing, dense and compact **P. glauca densata**
8. Tree more open in habit **P. glauca**
(Canada and northern U.S.) Zone 2
P. glauca albertiana
(Alaska and British Columbia to Montana) Zone 2
(NOTE: It is difficult to tell these two apart with the naked eye. *P. glauca albertiana* is considered a geographical variety of the species.)
5. One year twigs definitely a red brown
 6. Cones $2\frac{1}{4}$ to $4\frac{3}{4}$ inches long **P. bicolor**
(Japan) Zone 4
 6. Cones 2 to 3 inches long **P. Glehnii**
(Japan) Zone 3
(Here is a case where differentiation between these two species without a lens and without fruit is very difficult; the differences are largely those of *degree*. The white markings on the upper surface of the needles of *P. bicolor* are more intense, whereas the pubescence of the branchlets and the dark green color of the branchlets of *P. Glehnii* is more marked.)
4. Needles more than $\frac{3}{4}$ inch long
 5. Needles flat in cross section; see Fig. 6, p. 62.
 6. Branchlets glabrous; foliage intensely white when observed from underneath branch **P. sitchensis**
(Alaska to California) Zone 6
 6. Branchlets pubescent; usually markedly pendulous; foliage not intensely white when observed from underneath branch
(Oregon to northern California) Zone 5 **P. Breweriana**
 5. Needles angular in cross section, usually 4-sided
 6. Winter buds resinous **P. Smithiana**
(Himalayas) Zone 6
 6. Winter buds not resinous **P. Schrenkiana**
(Central Asia) Zone 5
3. Foliage uniformly green
 4. The majority of the needles $\frac{1}{2}$ inch or less in length
 5. Needles flattened against branchlets; a markedly uniform dark glossy green above and below **P. orientalis**
(Caucasus and Asia Minor) Zone 4
 5. Needles not flattened against branchlets except in some *P. Abies* varieties which are dwarf shrubs and not trees; nor a marked uniform glossy green above and below except sometimes in *P. rubens*

6. Plants usually low, dense, dwarf shrubs **P. Abies varieties**
(NOTE: Some 26 dwarf varieties are offered in the trade.)
6. Plants not low, dense, dwarf shrubs, but trees
 7. One year twigs yellowish, foliage gray green **P. glauca**
(Canada and northern U.S.) Zone 2
 7. One year twigs reddish brown; foliage green
 8. Needles only slightly glossy, branchlets pubescent
(Nova Scotia to North Carolina) Zone 2 **P. rubens**
 8. Needles not glossy, branchlets glabrous **P. koyamai**
(Japan and Korea) Zone 4
4. The majority of the needles at least $\frac{1}{2}$ inch and usually approaching $\frac{3}{4}$ inch in length
5. Foliage dark green, branchlets usually orange
 6. Terminal bud lustrous, dark brown, prominent, about $\frac{1}{4}$ inch long; its tight fitting scales remaining snugly tight fitting and blackish at base of branchlets for several years; foliage decidedly harsh to the touch; see Fig. 4, p. 60 **P. polita**
(Japan) Zone 5
 6. Terminal bud not lustrous. The scales if they remain at the base of the current year's branchlets are curled and indistinct, not snugly tight fitting; foliage not harsh to the touch; see Fig. 4, p. 60 **P. Abies**
(North and Central Europe, escaped in U.S.) Zone 2
5. Foliage grayish green, one year twigs yellowish
 6. Needles usually rigidly upright on the upper side of the branchlets; needles dense, even on four year old branchlets; tree open in habit **P. glauca**
(Canada and northern U.S.) Zone 2

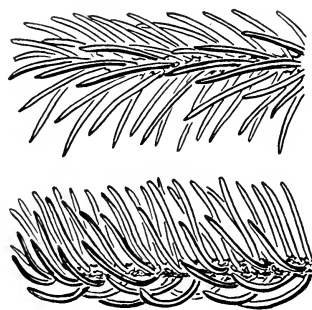


FIGURE 7. Side view of shoot of *Picea obovata* (above) and *Picea glauca* (below) showing the difference in the way the needles are borne on the twig.

6. Needles usually appressed or held closely along the upper side of the branch, not upright; needles sparsely borne; tree dense and conical in habit **P. obovata**
(Northern Europe to Kamchatka and Manchuria) Zone 2
3. Foliage bronze golden, at least when the needles first appear in spring. The majority of the needles less than $\frac{1}{2}$ inch long; plant a tree **P. orientalis aurea**

DONALD WYMAN

ARNOLDIA



A continuation of the BULLETIN OF POPULAR INFORMATION of the Arnold Arboretum, Harvard University

VOLUME 3

DECEMBER 31, 1943

NUMBER 12

A SIMPLE FOLIAGE KEY TO THE FIRS

THIS simple foliage key to the firs is the third and last in this series of keys to the narrow-leaved evergreens, and all statements made concerning the other two (Simple Key to the Pines: *Arnoldia*, 3: No. 10, 1943; and a Simple Foliage Key to the Hemlocks and Spruces: *Arnoldia*, 3: No. 11, 1943) apply to this key to the firs.

The firs are perhaps the most difficult of the four groups of plants to tell apart because their needles vary considerably in size and shape, and the color of the twigs and the amount of pubescence on them also varies.

There are ten fir species native to this country, all of which are included in the following key, in addition to fifteen exotic species and six varieties. All of these are either native or being grown commercially at some place in the United States. As with the pines and spruces, many more firs are being grown in botanical gardens and arboretums in this country but their cultivation is limited to such an extent that they are not available at this time to the plant buying public in sufficient quantity to warrant their inclusion in this key.

The Zones refer to the Hardiness Map, *Arnoldia*, 3: No. 10, 1943, p. 53. The habitats are given for all species appearing in the key, for such information is often helpful in identifying these plants in the field.

Note: The three simple foliage keys to the evergreens given in this and the two preceding numbers of *Arnoldia* should materially aid the gardening enthusiast or woodsman in his associations with this valued group of plants. The keys cover practically all the pines, hemlocks, spruces and firs native in large areas in this country or grown in quantity in our commercial nurseries. Actually, 104 evergreen trees are included in these keys, of which 41 species are native to this country. This is about all the evergreens in these groups which one would normally find in the woods, parks and gardens of the United States. It is hoped that these keys may stimulate an interest in the names and relationships of these conifers. They were planned to be used with living plants. Use them and learn to know your evergreens!

SIMPLE FOLIAGE KEY TO THE FIRS

Native or available in North America

Leaves single, leaving a circular scar when falling: without persistent prominent leaf bases on the twigs **Abies, Pseudotsuga**

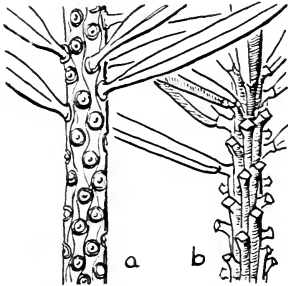


FIGURE 8. a. Twig of fir showing the smooth twig surface when the leaves have fallen

b. Twig of spruce, showing the small leaf bases (making a rough twig surface) which remain after the leaves have fallen

1. End bud sharply pointed, long and narrow, with many scales, not resinous; fruit a pendulous cone, needles spreading radially on all sides of twig

Pseudotsuga taxifolia—Douglas-Fir

Pseudotsuga taxifolia glauca

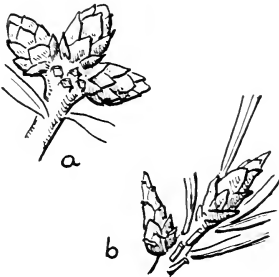


FIGURE 9. a. Terminal bud of fir

b. Terminal bud of *Pseudotsuga taxifolia* showing its many scales and long pointed character distinctly different from the buds of any fir

2. Foliage green ***Pseudotsuga taxifolia***
(British Columbia to western Texas) Zone 6

2. Foliage bluish green ***P. taxifolia glauca***
(Rocky Mountains) Zone 4

1. End bud not long and narrow and sharply pointed, mostly resinous; fruit upright, needles of most species (except *A. Pinsapa* and *A. koreana*) not spreading radially on all sides of twig (see Figs. 9 and 10) **Abies species**

alba—Silver Fir

alba pyramidalis

amabilis—Cascades F.

balsamea—Balsam F.

cephalonica—Greek F.

chensiensis—Shensi F.

cilicica—Cilician F.

concolor—Colorado F.

concolor violacea

firma—Momi F.

Fraseri—Southern Balsam F.

Fraseri prostrata

grandis—Giant F.

holophylla—Needle F.

homolepis—Nikko F.

koreana—Korean F.

lasiocarpa—Rocky Mountain F.

lasiocarpa arizonica

magnifica—Red F.

Mariesii—Maries F.

Nordmanniana—Nordmann F.

Pinsapo—Spanish F.

Pinsapo glauca

procera (formerly *A. nobilis*)—Noble F.

procera glauca

religiosa—Sacred F.

sachalinensis—Saghalin F.

sibirica—Siberian F.

spectabilis—Himalayan F.

Veitchii—Veitch F.

venusta—Bristle-cone F.

2. Needles mostly $\frac{3}{4}$ inch or less in length

3. Needles spreading radially on all sides of twig

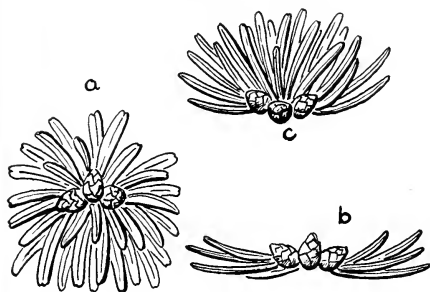


FIGURE 10. a. *Abies koreana* showing needles spreading radially
b. *Abies alba* showing needles distinctly 2-ranked
c. *Abies Nordmanniana* showing needles appearing on sides and from upper surface of twig

4. Needles intensely white beneath, usually blunt and rounded at the tip **A. koreana**

(Korea) Zone 5

4. Needles greenish to greenish white beneath usually pointed at the tip **A. Pinsapo**

(Spain) Zone 6

4. Needles glaucous or bluish **A. Pinsapo glauca**

3. Needles not radially distributed; apparently more or less 2-ranked, that is with needles appearing on the two sides of the twig and frequently on the upper surface as well (see Fig. 10)

4. Needles lustrous green above, white or whitish beneath: stomate lines present on under surface only

5. Needles, especially on 2 year old twigs, directed toward tip of branch (see Fig. 12) **A. Mariesii**

(Japan) Zone 5

5. Needles, especially on 2 year old twigs, more or less at right angles to the twigs (see Fig. 12)

6. Plant a tree **A. balsamea**

(Labrador to W. Virginia and Iowa) Zone 3

A. Fraseri

(Allegheny Mts., W. Virginia and Tennessee) Zone 4

(These two are closely related and difficult to tell apart without

cones or without a lens. The under surface of the needles of *A. Fraseri* has 8 to 12 lines of stomates in each white band, while that of *A. balsamea* has only 4 to 8 lines in each white band)

6. Plant a prostrate shrub **A. Fraseri prostrata**
4. Needles gray green above and below, due to the fact that stomate lines (seen with a lens) are on both upper and lower needle surfaces
5. One year twigs ashy gray
 6. Bark or trunk gray **A. lasiocarpa**
(Alaska to New Mexico) Zone 3
 6. Bark of trunk creamy white and corky **A. lasiocarpa arizonica**
 5. One year twigs rusty brown
 6. Foliage bluish green **A. procera** (*A. nobilis*)
(Washington to California) Zone 5
 6. Foliage glaucous or bluish **A. procera glauca**
2. Needles more than $\frac{3}{4}$ inch in length
3. Needles green and lustrous above; no lines of stomates on upper surface of needles (when observed with a lens)
4. Needles definitely pointed at tip

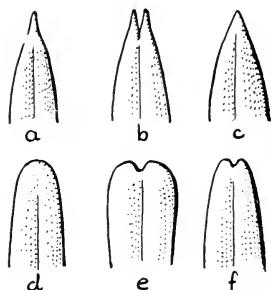


FIGURE 11. a. Tip of needle of *A. holophylla*
 b. Tip of needle of young *A. firma*
 c. Tip of needle of *A. cephalonica*
 d, e, f. Rounded and slightly notched needles commonly found on most firs. When any of these types make up a majority of the needles of a specimen, the needles are considered to be *blunt* as far as this key is concerned

(NOTE:—For the purposes of this key needles similar to those of a, b and c are considered *pointed* or sharp. This can usually be felt by gently squeezing the ends of the needles. Those similar to d, e and f are considered *blunt*. It should be understood that needles vary greatly and some trees will have differently shaped needles, often on the same branch. Typical needles should be considered to be those appearing on the specimen in the greatest number)

5. Majority of needles especially on 2 year old twigs at right angles to the twigs (see Fig. 12)
 6. Branchlets glabrous; vigorous shoots have needles with only one point
 7. Twigs deeply grooved (see Fig. 12) **A. homolepis**
(Japan) Zone 4
 7. Twigs not deeply grooved

8. White lines clearly visible on the lower surface of the needles; needles frequently produced on all sides of twig (Greece) Zone 5 **A. cephalonica**
8. White lines only faintly visible on the lower surface of the needles; needles often curved and pointing directly upward, not appearing radially arranged (Manchuria, Korea) Zone 5 **A. holophylla**
6. Branchlets slightly pubescent; vigorous young shoots may have needles with two sharp points (see Fig. 11) (Japan) Zone 6 **A. firma**
5. Majority of needles not at right angles to twig (see Fig. 12)
6. Needles less than $1\frac{1}{2}$ inches long
7. One year twigs glabrous (Manchuria, Korea) Zone 5 **A. holophylla**
7. One year twigs pubescent (Mexico) Zone 9-10? **A. religiosa**
6. Needles $1\frac{1}{2}$ to $2\frac{1}{4}$ inches long (California) Zone 8 **A. venusta**
4. Majority of needles blunt and rounded at tip or slightly notched at the tip (see Fig. 11)
5. Needles, especially on 2 year old twigs, mostly at right angles to the twigs

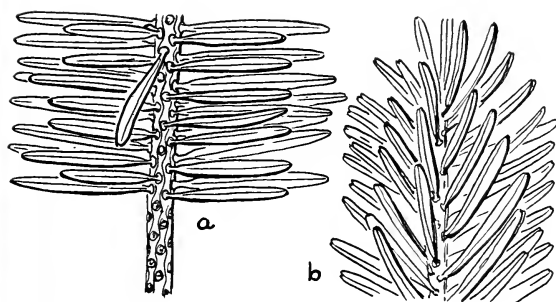
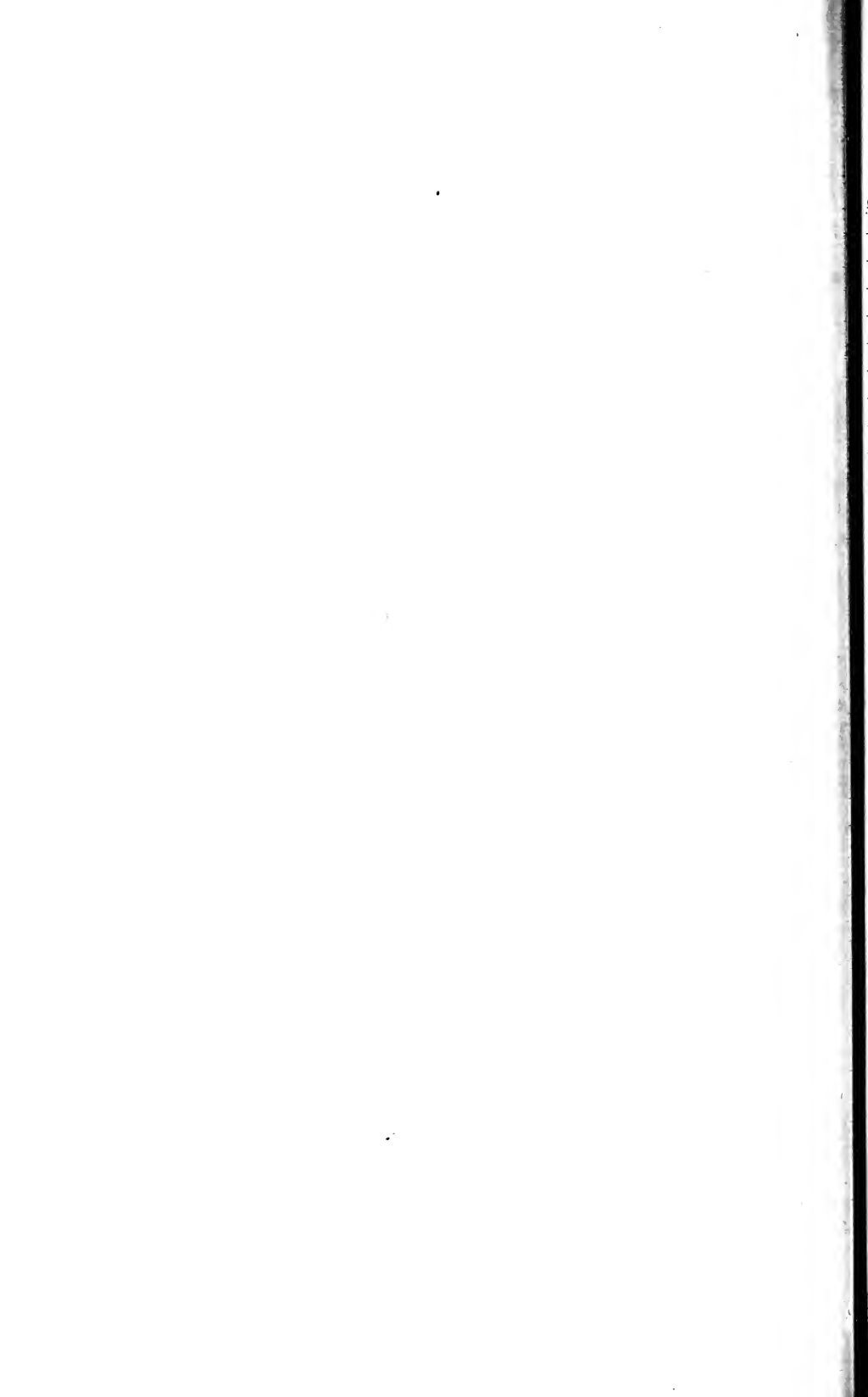


FIGURE 12. a. Needles mostly at right angles to twigs as in *A. homolepis*, also showing longitudinal lines or grooves in twig.
b. Needles mostly directed towards the tip of twigs as in *A. Nordmanniana*

6. Branchlets glabrous
7. Foliage intensely white beneath; twigs deeply grooved (see Fig. 12) (Japan) Zone 4 **A. homolepis**
7. Foliage green beneath; twigs not deeply grooved (Central China) Zone 6 **A. chensiensis**
6. Branchlets pubescent
7. Branchlets slightly pubescent, one year twigs often have faint grooves; needles on vigorous shoots frequently pointed, needles up to $1\frac{1}{2}$ inches long (Japan) Zone 6 **A. firma**

9. Leaves closely arranged in two ranks like teeth in a comb (see fig. 10)
 10. Tree pyramidal in habit **A. alba**
(Mountains of Central and Southern Europe) Zone 4
 10. Tree columnar in habit **A. alba pyramidalis**
9. Leaves not in two closely arranged ranks
 10. Needles of one year twigs very white beneath, the upper ones directed forward and closely appressed to the twigs **A. Nordmanniana**
(Caucasus Mts. and Asia Minor) Zone 5
 10. Needles of one year twigs merely greenish white beneath, more or less spreading and with a V-shaped depression above, not closely appressed to the twigs (Asia Minor, Syria) Zone 5 **A. cilicica**
(These two are difficult to tell apart without the cones. The Nordmann Fir is by far the more common of the two in this country)
3. **Foliage dull grayish or bluish green above and below because there are stomatiferous lines on both upper and lower surfaces of the needles**
(These can be seen with a lens)
 4. Needles flat in cross section (as in *Picea Omorika*, *Arnoldia* 3: No. 11, 1943, Fig. 6, p. 62)
 5. One year twigs glabrous
 6. Foliage bluish green **A. concolor**
(Colorado to California and New Mexico) Zone 4
 6. Foliage a bluish white **A. concolor violacea**
 5. One year twigs pubescent
 6. Twigs ashy gray
 7. Bark of trunk gray **A. lasiocarpa**
(Alaska to New Mexico) Zone 3
 7. Bark of trunk creamy white and corky **A. lasiocarpa arizonica**
 6. Twigs rusty brown
 7. Foliage bluish green **A. procera** (*A. nobilis*)
(Washington to California) Zone 5
 7. Foliage glaucous or bluish **A. procera glauca**
 4. Needles, at least some of them, quadrangular in cross section, similar to the cross section of those of *Picea glauca* (see *Arnoldia* 3: No. 11, 1943, Fig. 6, p. 62) **A. magnifica**

DONALD WYMAN



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